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MOSS FLORA

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OF

NORTH AMERICA

North of Mexico

BY

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Family HYPNACEAE

Plants creeping in habit, forming mats of more or less closely interwoven stems and branches, growing mainly on soil and rotten wood, less frequently but commonly on stones and trunks of trees, a few aquatic.

Leaves costate or ecostate, not papillose, except *Bryhnia*, *Isothecium*, and *Hylocomium* species. Capsules on elongated setæ more or less curved and unsymmetric except in the *Climacieæ*, *Entodonteæ* and a few anomalous mosses. Peristome usually perfect, the cilia often lacking in mosses with erect capsules, segments always keeled; teeth strongly articulate, marked at base between the articulations by characteristic fine transverse lines except in a few forms with erect capsules and degenerate peristomes. A very large family closely related to the *Leskeaceæ*, from which it differs in the non-papillose leaves and also usually in the longer leaf cells and unsymmetric cernuous capsules. The peristomes are very close to those of the *Bryaceæ* except for the fine transverse lines on the peristome teeth.

This family is a large and somewhat heterogeneous one and includes practically all the pleurocarpous mosses with elongated smooth leaf cells and well-developed peristomes, *i. e.*, having broad keeled segments and, usually, well-developed cilia. Although the leaf cells are often short and broad, they are more or less rhomboidal or elongated-hexagonal in outline and in the middle of the leaf are never regularly oval, rounded, or quadrate.

The mosses of this family may be found in all kinds of habitats, and some individual species have a wide range of habitat.

The classification of this family is a matter upon which no two bryologists would be likely to agree. No single character can be relied upon as a basis of classification, and it is extremely difficult to select combinations of characters that will indicate relationships with any degree of accuracy. Many characters relied upon in the past are almost certainly very highly modified, if not actually produced, by habitat conditions. Short thick-walled leaf cells are so frequently correlated with a xerophytic habitat as to suggest a causal relation. There is almost certainly a relation between habitat and the curvature and direction assumed by the capsule, and between this last and the completeness of the peristome. These statements, of course, apply to mosses outside this family, but the difficulties in classification caused by these facts are particularly prominent here.

The following grouping into subfamilies is primarily based more on the structure and robustness of the costa and the presence or absence of central strand in the stems than most of the older groupings. For exceptions to the characters indicated in this key see the descriptions of the subfamilies.

Key to Subfamilies of the Hypnaceae.

corrected key p 266

1.	Costa strong and extending to the middle of the leaf or beyond, nearly always single (exceptions in *Hylocomium* and *Campylium*)	3.
	Costa short and double or lacking	2.
2.	Capsules erect and symmetrical, or nearly so; cilia of inner peristome rudimentary or lacking	*Entodonteæ.*
	Capsules unsymmetric, more or less curved, usually cernuous	*Hypneæ & Sematophylleæ.*

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3. Plants large, secondary stems stout and dendroid from creeping or stoloniferous primary stems ..... 4.
   Plants smaller, scarcely dendroid ..... 5.
4. Capsules erect and symmetric (exc. Girgensohnia); peristome without cilia ..... *Climacieæ.*
   Capsules curved, cernuous; peristome perfect ..... *Porotricheæ.*
5. Capsules ovoid, short, thick and unsymmetric, usually little contracted under the mouth when dry; stem and branch leaves often quite different ..... 6.
   Capsules longer, arcuate-cylindric as a rule, usually more contracted under the mouth when dry ..... *Amblystegieæ.*
6. Costa single and usually reaching well beyond middle of leaf; seta often rough; paraphyllia lacking ..... *Brachythecieæ.*
   Costa frequently double, often short; paraphyllia large and abundant in many species; seta smooth ..... *Hylocomieæ.*

Subfamily CLIMACIEAE

Characterized in general by the dendroid habit from a creeping, strongly radiculose primary stem (except forms of *Climacium Kindbergii*) having a well-marked central strand, strongly costate leaves, secondary stems and branches bearing numerous filiform paraphyllia, erect symmetric capsules and well-developed peristome, with cilia rudimentary or lacking, as are the fine transverse lines on the base of the peristome teeth (except Girgensohnia). The relationships of the genera included in this subfamily are problematical and it is doubtful if Climacium and Girgensohnia belong in the same subfamily, but superficial appearances, at least, will cause them to be associated with each other and the Porotricheae.

Key.

Capsules erect, symmetric; leaves scarcely decurrent ..... *Climacium.*
Capsules curved and cernuous; leaves long-decurrent with hyaline inflated cells ..... *Girgensohnia.*

CLIMACIUM Web. & Mohr, Iter Suec. 96. 1804. (Reise durch einem Theil Schwedens).

Large handsome mosses with a tree-like habit of growth from underground creeping stems (p. 300 and 301 M.H.M.*). Sometimes prostrate, or floating in very wet places. Stem and branches bearing paraphyllia. The leaves vary greatly in shape and structure. Those figured are from the middle of well-developed branches. The leaves of the main upright stems are very large, thin, with little chlorophyll, closely imbricated and clasping. Branch leaves smaller, of a different shape and texture, chlorophyllose. All our species are dioicous. The seta is long and smooth, twisted to the right when dry. Calyptra split on one side, long, reaching to the base of the capsule. Capsule erect, cylindric; operculum conic-rostrate with the beak often oblique; annulus none; peristome double; teeth linear-lanceolate, very long, closely articulate, minutely papillose; segments as long as the teeth, keeled, split between the articulations, often split to the apex when old, united at the base into a continuous narrow basal membrane, minutely papillose; cilia lacking or rudimentary. Type species *C. dendroides.*

Mosses of swampy woods and fields; fruiting with comparative infrequency. The systematic position of this genus is as yet doubtful. It certainly does not belong in the Entodonteæ, where it has previously been placed. The lack of transverse lines on the peristome teeth indicates that it is either not a member of the family Hypnaceae or else is a very highly modified member. It has been placed near the Fontinalaceae but I have changed my opinion as to this relationship and can see little evidence to support such an arrangement.

Key.

1. Capsules 3 to 4 times as long as broad; median leaf cells 7–10-times as long as broad... *dendroides.*
   Capsules 5–6: 1; median leaf cells not more than 7: 1 ..... 2.
2. Plants of a distinctly tree-like habit; median leaf cells 5–7: 1 ..... *americanum.*
   Plants growing in dense tufts so that the tree-like habit is obscured, or prostrate and hypnoid in appearance; median leaf cells 2–3: 1 ..... *Kindbergii.*

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* M.H.M. = Mosses With Hand-lens and Microscope.

CLIMACIUM DENDROIDES (L.) Web. & Mohr, Iter. Suec. 96. 1804.

Hypnum dendroides L. Sp. Pl. 118. 1753.

Plants dark to bright green, 7–9 cm. tall; branches suberect to spreading; branch leaves loosely imbricate, about 2 × 0.7 mm., upper oblong-lanceolate; lower ovate-lanceolate to oblong-lingulate, obtuse, denticulate at base, sharply serrate above, bisulcate, costate nearly to apex; basal angles sometimes slightly enlarged; median cells linear-rhomboidal to linear-hexagonal, 7–10: 1; alar and apical cells much shorter and broader; stem leaves larger, 2–3 mm. long, ovate, entire, apiculate. Perichaetial leaves about 5 mm. long; inner oblong to oblong-ovate, slightly serrate at apex, long-acuminate, thinly costate, costa often short or wanting; leaf cells linear above, rhomboidal and brownish yellow below. Seta reddish brown, 2.5–3.5 cm. long; capsule lighter in color, cylindric, about 4 mm. long, 3–4: 1; operculum often remaining attached to the columella; spores 13–22 μ. Fruit rather infrequent and sparingly produced, maturing in autumn.

Type locality: European, probably Swedish.

Wet ground, especially borders of streams, swamps and lakes, frequent, ranging through the northern and western part of the continent from New Brunswick to St. Paul Island, Behring Sea; south to New Jersey, Colorado, New Mexico and California. Not reported from the North Central states.

ILLUSTRATIONS.—Br. & Sch. Bryol. Eur. *pl. 437* and in many other works.

EXSICCATI.—Drumm. Musc. Am. 230; Austin, Musc. Appal. 286; R. & C. Musc. Am. Sept. Exsic. 237; Macoun, Can. Musc. 264; Grout, N. Am. Musc. Pl. 157, 329, and 440 (as *C. americanum*); Musci Perfecti 139.

VAR. OREGONENSE R. & C. Bot. Gaz. **15**: 59. 1890. "Differs from the type in the leaves narrowed at base, less serrulate at apex, sometimes subentire." Oregon, Willamette R. (L. F. Henderson).

A form from Sauvies Island, Oregon, has almost entire leaves that are broader than usual instead of narrower. (C. G. Pringle, no. 510.)

Number 12346, of Fernald and Long from "shaded rock pockets and crevices covered at high tide in the valley of the Cathance R., Sagadahoc Co., Maine," consists of floating stems only, with spreading leaves that are intermediate between stem and branch leaves. A very interesting form and difficult to place.

CLIMACIUM AMERICANUM Brid. Musc. Recent. Suppl. part **2**: 45. 1812.

Neckera dendroides americana C. Muell. Syn. **2**: 122. 1852.

Plants 5–7 cm. high; branches usually straight and tapering; branch leaves closely imbricate, 2 × 1 mm.; upper oblong-lanceolate, *broadly auriculate;* lower ovate to ovate-lanceolate, denticulate below, sharply serrate above, more acute than in the last, bisulcate, costate nearly to the apex; leaf cells more nearly uniform than in *C. dendroides;* median cells oblong-hexagonal, 5–7 : 1; stem leaves as in *C. dendroides;* perichaetial leaves oblong-ovate, 4–5 mm. long, much like those of the preceding. Capsule cylindric, about *6 mm. long, 5–6:1;* peristome teeth sometimes slightly perforated: spores maturing in autumn. Distinguished from *C. dendroides* by its more closely imbricated leaves, broadly auriculate branch leaves, longer capsules and shorter leaf cells.

Type locality: Lancaster, Pennsylvania.

Swamps, wet soil, rotten logs, etc.

This species is exclusively American. It is found in the northern and eastern states, ranging from Canada to North Carolina and probably south to the Gulf; west nearly or quite to the Rocky Mts.

ILLUSTRATIONS.—Sull. Mosses of the U. S. *pl. 5* & Icon. Musc. *pl. 97.*

EXSICCATI.—Drumm. Musc. Am. 231; Sull. & Lesq. Musc. Bor. Am. Ed. 1, 271, Ed. 2, 402; Austin, Musc. Appal. 287; Macoun, Can. Musc. 265; Grout, N. Am. Musc. Pl. 165.

CLIMACIUM KINDBERGII (R. & C.) Grout, Bryologist **4**: 54. July, 1901.

Climacium americanum Kindbergii R. & C. Bot. Gaz. **15**: 59. 1890.

Plants *dark green, almost black,* below rarely lighter green, *growing typically in dense tufts or cushions* in very wet swamps, somewhat tree-like in habit, but growing so compactly together as to obscure the dendroid appearance. On the edges of pools and on sticks and stones in pools the stems are decumbent, irregularly branching, often floating, dendroid secondary stems rarely present.

Stem leaves scattering, ovate; branch leaves ovate-lanceolate, somewhat auriculate, less differentiated than in *C. americanum,* clasping by enlarged rounded basal angles, sulcate; areolation nearly uniform;

median cells oblong-hexagonal, 2–3:1. Seta usually much longer and more flexuous than in *C. americanum;* capsule about the same as in that species, 4–6 mm. long; teeth of peristome usually more or less perforate. Spores in autumn. Swamps, having the range of the preceding species, extending to Florida and the Gulf States, where it frequently assumes the dendroid form. When growing out into the water it sometimes has the habit of a Fontinalis with distant leaves.

Type locality: Lafayette Woods, Louisiana (Langlois).

Exsiccati.—Austin, Musc. Appl. 288 & 289 as *C. americanum fluitans;* R. & C. Musc. Am. Sept. Exsic. 238; Grout, N. Am. Musc. Pl. 98. Some specimens at least, of Sull. & Lesq. Musc. Bor. Am. Ed. 2, 42 & Drummond's Musc. Am. (S. States) 120 are this species.

Although Brotherus in the second edition of Engler & Prantl, Natürlichen Pflanzenfamilien does not recognize this species, I am still of the opinion that it is a good species closely related to *C. americanum,* as occasional forms with the short leaf cells and a dendroid habit or auriculate leaves are occasionally met with. The typical form seems most abundant along the coast and in the South; in general this species has the range of *C. americanum,* but is much less frequent inland than that species. Aquatic forms of the other two species may be confused with this. Usually distinguished at a glance by its color and habit of growth; surely determined by the larger, proportionately broader branch leaves without the conspicuous auricles of *C. americanum,* yet more auriculate than *C. dendroides,* and specially by its *very short leaf cells.*

GIRGENSOHNIA Kindb. Spec. Eur. & N. Am. Bryn. Pt. 1: 43. 1896.

Climacium Sec. B, Girgensohnia Lindb. Act. Soc. Fenn. 10: 248. 1872.

Pleuroziopsis Kindb. Ck. List Eur. & N. Am. Moss. 19. 1894.

(*P. ruthenica* was the third species named in a bare list of four and cannot be taken as the type species.)

Only one species is known. (*Plate I.*)

Girgensohnia ruthenica (Weinm.) Kindb. l. c.

Hypnum ruthenicum Weinm. Bull. Soc. Imp. Mosc. 18: Pt. 2: 485. 1845.

Plants light green, from creeping stoloniferous primary stems, dendroid, one-sided, suggesting minute *Pteris aquilina;* secondary stems erect, reaching 8 cm. or more in height; branching pinnate to bipinnate; branchlets slender, attenuate, 5–10 mm. long, covered with simple and branched filiform paraphyllia; stem leaves scale-like, clasping, broadly ovate, narrowed to insertion, rounded or apiculate at the obtuse apex, entire, with a thin slender costa extending to middle (Sullivant says "*enervia vel valde nervosa*"); leaf cells long and narrowly linear-vermicular, basal cells shorter and broader. Leaves of branches ovate, rather obtuse, entire or serrate at apex, strongly costate to near apex, long-decurrent with hyaline inflated cells; median cells narrowly linear-vermicular; leaves of branchlets loosely imbricate, lanceolate, decurrent as in the branch leaves, bisulcate, strongly serrate above, strongly costate nearly to apex; costa dentate on the back above; median leaf cells linear-vermicular, upper broader and shorter; inner perichaetial leaves closely imbricate, broadly ovate, long cuspidate-acuminate, costate; outer ecostate. Dioicous. Seta short, smooth, calyptra cucullate, covering only ½ the capsule; capsule oblong-cylindric, arcuate, cernuous, operculum long-conic, almost rostrate; annulus lacking; peristome teeth broader than in Climacium, hyaline-margined; segments also broader, open between the articulations, more or less papillose, as long as the teeth; cilia lacking; spores 15–20 μ.

Type locality: "In insula Sitka."

Seattle, Vancouver Island, Alaska, Japan.

Illustration.—Sull. Icon. Suppl. *pl. 58; Pl. 1.*

POROTRICHEAE.

Plants more or less *dendroid in habit from creeping stoloniferous stems;* stems and branches with central strand; leaves strongly costate; leaf cells short and broad; seta long; capsules somewhat unsymmetric and inclined, with a perfect hypnaceous peristome.

Brotherus in Engler & Prantl puts this group in the Neckeraceae, a disposition with which I cannot agree. Dixon considers that the short areolation reads it out of the Hypnaceae but I would suggest that one consider the areolation in *Climacium dendroides* and in *C. Kindbergii* as illustrating the variations in areolation in so small a group as this very clear-cut genus. To me it seems that the affinities of Bestia are with this group rather than with the Crypheaceae.

KEY.

1. Plants large, robust, plainly dendroid when well developed, not complanate foliate... *Porotrichum.*
   Plants either not dendroid or much smaller and more delicate, many complanate-foliate..... 2.
2. Plants distinctly complanate-foliate, resembling *Plagiothecium sylvaticum* in aspect.. *Porothamnium.*
   Plants more slender, less markedly *Plagiothecium*-like, pinnately branching or dwarfed-dendroid..... *Bestia.*

POROTRICHUM Brid. Bryol. Univ. **2**: 275. 1827. Thamnium Br. & Sch., Bry. Eur. 1852.

Though Thamnium was used for the name of this genus earlier than Porotrichum, it had previously been used for three other genera of plants according to Dixon, Hdbk. 3d Ed. 408.

Plants dendroid from creeping stoloniferous stems, robust; leaves ovate to oval-oblong, strongly costate, serrate; leaf cells short and broad, thick-walled, basal longer and narrower, alar usually smaller and subquadrate; capsules usually somewhat inclined and arcuate; peristome perfect, cilia appendiculate. Type species *P. longirostre* (Hook.) Mitt.

KEY.

Middle branch leaves sharply acute; elongated cells usually extending beyond end of the costa itself ..... *alleghaniense.*
Some or all of the middle branch leaves broad and rounded in outline at the apex; costa much narrowed at the end but not continued by elongated leaf cells..... *neckeroides.*

POROTRICHUM ALLEGHANIENSE (C.M.) Grout, Mosses H.-lens & Mic. 303, April, 1908.

Hypnum alleghaniense C. M. Synopsis **2**: 502. 1851.
Thamnium alleghaniense Br. & Sch., Bry. Eur. fasc. 49–51, *pl. 4.* 1852.
Thamnium pseudoneckeroides Kindb., fide Cardot.

Conspicuously dendroid when well developed, robust; secondary stems 2–3 cm. long, rigid, inclined, naked or covered with small scale-like appressed leaves, very dark green in old or stunted plants, light green when young and vigorous; branches stout; median branch leaves loosely erect-open, 2–3 mm. long, ovate to elliptical-oblong, oblong-lanceolate on the smaller branches, narrowed to the subclasping insertion, *acute*, coarsely and irregularly serrate above, concave; costa stout, somewhat toothed on the back, a single layer of elongated cells often continuing beyond the costa; upper leaf cells near end of costa rhomboid-elliptic to oblong-hexagonal, *about 18 μ long, 2 : 1;* median cells often smaller and quadrate to hexagonal; median basal oblong to oblong-rectangular, 30–45 μ long, 4–6 : 1; those of the basal margin shorter, smaller and subquadrate: inner perichaetial leaves erect, narrowly acuminate, costate. "Monoicous or synoicous." Seta 10–15 mm. long, usually leaning from the vertical; capsule oblong to oblong-ovoid, somewhat cernuous, symmetric to slightly curved; urn 2–2 1/2 mm. long; operculum obliquely conic-rostrate, one-half the length of the urn; calyptra cuculate, small; annulus narrow; peristome perfect; teeth marked at base with the fine transverse lines characteristic of the Hypnaceae, hyaline and spinose-papillate above; segments from a wide basal membrane, as long as the teeth, open between the articulations, minutely papillose-roughened above, as are the two or three appendiculate cilia of an equal length; spores about 9 μ in diameter, maturing in autumn.

Type from near St. Louis, Drummond.

On damp rocks by streams and in cool shaded ravines. Widely distributed but not abundant and rarely developing to full size or fruiting. Northeastern U. S. and eastern Canada, south to Georgia, Alabama, Missouri and Arkansas. Occasionally a form is met with having some of the branches ending in slender leafy flagella.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 103.* M. H. M. 302.

EXSICCATI.—Drumm. Musc. Am. (Coll. II) as *Hyp. neckeroides;* Sull. & Lesq. Musc. Bor. Am. 288, 2nd Ed.; Sull. Musc. Allegh. 9; Austin, Musc. Appl. 337; Macoun, Can. Musc. 302; Grout, N. Am. Musc. Pl. 119.

POROTRICHUM NECKEROIDES (Hook.) Williams, Bull. N. Y. Bot. Garden **2**: 137. May, 1901.

Hypnum neckeroides Hook. Musc. Exot. *pl. 58.* 1818.
Thamnium Leibergii E. G. Britton, Bull. Torr. Bot. Club **16**: 111. 1889.

Plants rather coarser than in the last, dark to light green, dendroid when well developed; secondary stems ascending to erect; leaves of secondary stems stiff and rigid, broadly triangular-ovate below, longer and oblong-ovate above, usually broadly acute and faintly serrate at apex; costa very stout and much thickened below; these leaves graduate into the upper stem and lower branch leaves, which are much larger, broadly ovate and *rounded or obtusely acute* at the serrate apex; middle branch leaves 2–3 mm. long, broadly oblong-ovate, concave, *usually round-obtuse at apex*, occasionally broadly acute, strongly serrate above; costa stout, extending to near the apex, very strongly dentate on the back above with numerous stout teeth; upper leaf cells near the end of costa irregularly quadrate to hexagonal for the most part, *nearly as broad as long, about 15 μ in diameter;* basal cells much as in the last but tending to be shorter and broader. Dioicous. Capsules "oblong-ovate," cernuous; peristome perfect.

In the original plate the segments are shown as widely open between the articulations and the cilia are about ½ the length of the segments above the wide basal membrane. Hooker states that he had not seen the operculum, so that the capsules were not in prime condition and the cilia may have been broken off. Mrs. Britton gives as the only tangible difference between this species and *Thamnium Leibergii* that the cilia in the latter are as long as the segments. I have examined a considerable series of our western Porotrichum and can find but one species distinguishable by gametophyte characteristics.

Hooker gives New Zealand as the type locality of the species but Brotherus in the second edition of E. & P. does not credit the species to any region but N. America. As Menzies collected the type it is probable that he got his labels mixed, since he collected on the West Coast also. This seems to be the general opinion, so far as I can determine.

The broad rounded apex of the branch leaves so well shown in the original plate and the smaller isodiametric upper leaf cells distinguish this from the preceding at first sight.

At the ends of the branches and especially on small attenuate branches, the leaves may closely approach those of the last in outline and some of the cells near the end of the costa are markedly longer than broad. I have examined leaves from a branch of the type of *Thamnium Leibergii* and they seem to be more acute with more elongated apical cells than is characteristic of the general run of *P. neckeroides*.

Northwest U. S. and Canada west of the Rockies, seldom fruiting.

ILLUSTRATION.—Hooker, l. c.; *Pl. 1.*

EXSICCATI.—Allen, Mosses of the Cascade Mts., Oregon, 113; Grout, N. Am. Musc. Pl. Suppl. 19.

Thamnium micro-alopecurum Kindb. Rev. Bryol. 22: 81. 1895. Type from Oregon, Hertzman.

The specimens were sterile. The description is inadequate and might apply to a dozen different mosses. Attempts to get a more definite description or a portion of the type have failed. Considering the well-known quality of Kindberg's work, the species may well be ignored unless the type can be examined by a competent authority.

The report by Macoun of the occurrence of the European *P. alopecurum* in British Columbia is a mistake. This species is dioicous and has branch leaves with the narrowly acute apex of *P. alleghaniense*, with upper leaf cells like those of *P. neckeroides* but even smaller, Limpricht says 7 μ but I make them nearer 10 μ in diameter; the leaves are narrower than in either of our species.

POROTHAMNIUM Fleisch. Moosfl. Java 3: 925. March, 1908.

Differing from Porotrichum in our forms chiefly by the more compact, less distinctly dendroid growth and complanate leaf arrangement.

We have but one species as *P. neo-mexicanum* Card. of which I have the type collection, should be referred to *Neckera* unless the sporophyte characters, when determined, locate it elsewhere.

POROTHAMNIUM BIGELOVII (Sull.) Fleisch. (fide Broth.).

Hypnum Bigelovii Sull. Pacific R. R. Reports 5[4]: 189. *pl. 8.* 1856.

Plants bright shining green, subdendroid from a creeping stem, arcuate-ascending, irregularly branching from the upper part of the secondary stems; stems and branches strongly complanate-foliate; leaves spreading, elongated oblong, about 3 mm. long, acute, sharply and coarsely serrate above, costate to near apex, basal margin of lower edge strongly inflexed; upper leaf cells rhomboid, about 30 μ long, 2–3 : 1; median oblong-linear, 30 × 8 μ in the middle of the leaf to linear, 67 × 9 μ, near base; basal row or two thick-walled, colored; inner perichaetial leaves broadly lanceolate, narrowly long-acuminate, costate, serrate above. Dioicous. Seta 2–2.5 cm. long; capsule oblong-ovoid, cernuous, nearly symmetric; operculum conic-rostrate; annulus of two or three rows of cells; calyptra cucullate; peristome perfect; spores in spring. Type from near San Francisco, Calif.

On moist shaded rocks, sometimes in reach of salt spray.

ILLUSTRATION.—Sull. l. c.; *Pl. 1.*
San Francisco northwards along the coast ranges to Vancouver; Idaho.
EXSICCATI.—Allen, Mosses of the Cascade Mts. 114; Grout, N. Am. Musc. Pl. 82.

The herbarium specimens, at least, of this species, resemble *Plagiothecium* very strongly. The ends of the branches are sometimes flagellate.

BESTIA Broth. E. & P. I, **3**: 858. 1906.

Plants small to medium size. Leaf cells thick-walled; upper ovoid to oblong-rhomboidal; lower basal cells longer, sublinear; a considerable area of angular cells very small and thick-walled, rounded quadrate to subcircular. Dioicous. Capsules nearly erect and symmetric, occasionally slightly unsymmetric and cernuous; seta smooth; peristome perfect, the base of the teeth marked with the fine transverse lines characteristic of the Hypnaceae. A genus of our Pacific coast. Type species *B. longipes* (Sull. & Lesq.) Broth.

The peristome clearly allies this unusually homogeneous genus with the Hypnaceae. *B. Breweriana* is surely more closely related to the other two species than to Tripterocladum with its leaves nearly ecostate and peristome without cilia.

KEY.

1. Branch leaves mostly obtuse and rounded at apex ..... *Holzingeri.*
   Branch leaves mostly sharply acute ..... 2.
2. Leaves closely appressed and branches julaceous when dry ..... *Breweriana.*
   Leaves subcomplanate, branches flattened ..... *longipes.*

B. occidentalis MF III 264 Western

BESTIA HOLZINGERI (R. & C.) Broth. E. P. I, **3**: 858. 1906.

Thamnium Holzingeri R. & C. Bot. Gaz. **19**: 239. 1894. *pl. 22 A.*

"Green, slender, rather resembling in habit the small forms of *Pseudisothecium myosuroides.* Primary stems creeping, stoloniferous, secondary ascending or decumbent, more or less shrub-like, pinnate, branches complanate, generally attenuate; lower stem leaves small, erect-spreading from a broadly deltoid base, ligulate-obtuse; costa vanishing about the base of the acumen; upper leaves larger, distichous, complanate, slightly asymmetric at the base, oblong-ligulate, obtuse or subobtuse, costa vanishing far from the apex, sometimes forking above; branch leaves smaller with the costa shorter and the lower margin inflexed, the upper leaves acute; all the leaves plane and crenulate-serrate on the margins, coarsely and irregularly dentate at the apex; areolation parenchymatous, cells incrassate, short, chlorophyllose, roundish or subhexagonal above, ovate or oblong in the middle, sublinear below, the alar small, rather obscure, subquadrate or roundish. Inner perichaetial bracts subvaginant, oblong-lanceolate, long loriform-acuminate, serrulate, costa thin, cells narrower; vaginule covered with numerous long paraphyses. Pedicel smooth, reddish, short (6–9 mm.). Capsule erect, oblong, subsymmetric, constricted under the orifice when dry, lid conic, obliquely beaked. Teeth of the peristome yellowish, lanceolate-acuminate, subulate, segments narrowly split along the divisural line, cilia 2, long, nodose. Seems to be dioecious."

As the species has not been widely collected I have quoted the original description in full, but I offer the following additions and corrections. The costa in the upper stem leaves extends ⅘ the length of the leaf; upper leaf cells oblong-hexagonal to rhombic, 15–18 μ long, about 2 : 1; a few lower basal cells oblong to oblong-rhomboidal or sublinear, 20–30 μ long, 4–5 : 1; middle branch leaves about 1 mm. long. Perichaetial leaves with spreading tips, the inner abruptly and narrowly long-acuminate, (acumination ½ as long as the rest of the leaf) serrate from the middle to base of the slender acumination, then sparingly dentate along its sides and sharply dentate at its apex: spores about 12 μ in diameter; capsules ovoid, about 1.5 mm. long, often somewhat cernuous; cilia appendiculate, nearly as long as the segments.

I do not find the costa in the branch leaves shorter and Cardot's figure shows the serrations on the leaf more correctly than his description.

Type from Myrtle Point, Coos Co., Oregon.

Pacific Coast, California to Vancouver. Apparently rare. Only 4 collections known to me.

ILLUSTRATIONS.—Cardot, l. c. (part of which is here reproduced in *Pl. 2*).
EXSICCATI.—Grout, N. Am. Musc. Pl. 15 (as Porotrichum).

A unique and pretty species that when sterile probably would be placed in Neckera or Homalia, but its peristome is of the perfect hypnaceous type.

BESTIA LONGIPES (Sull. & Lesq.) Broth. E. & P. I, 3: 859.

Alsia longipes Sull. & Lesq. Musc. Bor.-Am., Ed. 2, no. 399; and Sull. Icon. Musc. Suppl. 85, *pl. 63*.

Plants in soft diffused mats, light green; secondary stems ascending, pinnately to bipinnately branching almost from the base, frondiform, 3–5 cm. long, somewhat complanate-foliate; stem leaves ovate-lanceolate to triangular ovate, acute, serrate above, concave, margins recurved below; costa stout, extending well into apex, toothed on the back; leaf cells thick-walled, upper oblong-ovoid, about 15 m. long, 2 : 1; lower cells more elongated, reaching 23 μ, 3–4 : 1; a large area of alar cells thick-walled and rounded quadrate, colored, branch leaves oblong-lanceolate, smaller, more coarsely serrate at apex; elongated basal cells few or wanting, apex sometimes more rounded than figured: perichaetial leaves squarrose-spreading at apex, abruptly long-filiform acuminate, dentate above, inner costate. Dioicous. Antheridia mainly on the branches. Seta about 1.5 cm. long, borne on secondary stems; capsule cylindric; operculum obliquely rostrate; peristome perfect; teeth long and slender; segments a little shorter, split between the articulations; cilia two, somewhat shorter than the segments, appendiculate.

Type from California, Bolander.

ILLUSTRATIONS.—Sullivant, l. c.; *Pl. 2.*
EXSICCATI.—Sull. & Lesq., l. c.; Grout N. Am. Musc. Pl. 496.

BESTIA BREWERIANA (Lesq.) n. comb.

Hypnum (Isothecium) Brewerianum Lesq. Trans. Am. Phil. Soc. **13:** 12. 1863.
Tripterocladium Brewerianum (Lesq.) Fleisch. Laubm. von Java. 1906.
Hypnum aggregatum Mitt. Journ. Linn. Soc. **8:** 35. 1865. *pl. 6.*

Plants in compact dark green or occasionally yellowish green tufts; secondary stems ascending, bearing a few multicellular subfoliose paraphyllia, crowded, from a more or less prostrate primary stem, fasciculately branching; branches nearly simple, attenuate, curved and julaceous when dry, sometimes flagelliform; leaves imbricate and closely appressed when dry, erect-spreading when wet; lower stem leaves broadly ovate, abruptly acuminate, sharply serrate from base of acumen up; costa wide, ending near the middle; middle branch leaves broadly oblong-lanceolate to broadly ovate-lanceolate, concave below with reflexed margins, acute, sharply serrate above; costa usually extending well beyond the middle, often ending in a spine at back; upper leaf cells oblong-rhomboidal, 20–30 μ long by about 8 μ wide; median cells gradually elongated toward the base; basal cells linear-oblong, reaching 45 × 8 μ; basal angles with a large area of small thick-walled roundish-quadrate cells that reach ⅓–½ the distance to the costa and about ¼ the way up the leaf margin; inner perichaetial leaves oblong-lanceolate, slenderly long-acuminate, serrate above, faintly costate, with spreading tips. Sometimes monoicous. Seta 10–15 mm. long, smooth; capsule erect or nearly so, oblong-cylindric, usually somewhat unsymmetric, contracted under the mouth when dry; urn 1.5–2 mm. long; operculum conic-rostrate, often oblique, 0.5 mm. or more long; peristome perfect; teeth with very long slender tips which are spinose-papillose; segments as long as the teeth, open between the articulations, papillose; "cilia two, robust, equal to the segments"; annulus present, well developed; spores 15 μ in diameter, minutely roughened, maturing in winter. Type from California.

California to Vancouver. Frequent.

ILLUSTRATIONS.—Mitten, l. c.; *Pl. 2.*
EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. Ed. 2, 426; Macoun, Canadian Musci 294; R. & C. Musc. Am. Sept. Ex. 114; Grout, N. Am. Musc. Pl. 21, 21a, 432, 468.

VAR. LUTESCENS L. & J. Manual, 349. 1884.

"Pale dirty yellow; branches longer, stoloniferous; perichaetial leaves shorter, acuminate, serrulate; areolation shorter and broader; capsule longer, subcernous; cilia slender." Sull. & Lesq., Musc. Bor. Am. Ed. 2, 427, issued as this var. has little to distinguish it except shorter perichaetial leaves and a slightly more unsymmetric capsule.

VAR. HOWEI (Kindb.) n. comb.

Isothecium Howei Kindb. Rev. Bryol. 22: 82. 1925.

Dirty green; differs from typical forms in being much more slender; many branches stoloniferous; branch leaves oblong-lanceolate, narrowly long-acuminate; upper leaf cells oblong-linear, 30–40 μ long.

Type from beams of the "Old Mill," Mill Valley, Marin Co., California, Jan. 16, 1892. M. A. Howe. *Pl. 2.*

I have a type duplicate from Dr. Howe himself, and if this form had a normal habitat and were of frequent occurrence, I should consider it of specific rank.

A form of *Breweriana* collected on stumps in Mill Valley in 1892 and by A. S. Foster on a boulder near

the summit of Waldron Island, Puget Sound, July 6, 1907, has branch leaves longer acuminate than typical and upper leaf cells nearly as long as in var. *Howei*, yet the general leaf form was little different from typical *Breweriana* and the Mill Valley type is almost certainly an extreme habitat form or possibly a hybrid with the abundantly occurring and protean *Pseudisothecium stoloniferum*. Indeed, if it were not for the much larger area of small thick-walled cells in *B. Breweriana* it would be almost impossible to distinguish sterile forms of one from the other. Var. *Howei* has as slender pointed leaves as many forms of *P. stoloniferum* while the branch leaves of its var. *myurellum* (Kindb.), are as blunt as any of *B. Breweriana*. I strongly suspect that some of the many other puzzling forms of these two species are hybrids.

While the habit of *B. Breweriana* is somewhat different from that of the two other species, its microscopic structure is surprisingly similar. It also shows unmistakable relationship to *Pseudisothecium myosuroides*. My judgment does not make *Isothecium myurum* Brid. congeneric with *P. myosuroides* although the weight of opinion is against me. This genus and its allies belongs in the Hypnaceae near Eurhynchium, not in the Lembophyllaceae.

The description of *Isothecium hylocomiodes* Kindb. Eur. & N. Am. Br. 35. does not differentiate it in any way from a mere form of *B. Breweriana*.

Subfamily BRACHYTHECIEAE.

Hypnaceous mosses differing but little in general appearance from many of the Hypneæ, nearly always more or less glossy. The leaves are straight and imbricated when dry, occasionally loosely spreading, erect-open when moist; very rarely falcate or secund except in *Brachythecium velutinum* and its allies, often strongly plicate or sulcate, at least when dry, simply costate half way or more, leaf-cells linear-vermicular (except *B. reflexum*, *B. digastrum* and *B. cyrtophyllum*). Alar cells differentiated, often inflated and hyaline, sometimes quadrate and densely chlorophyllose.

Capsules brown to chestnut-brown, ovoid, short, cernuous and unsymmetric except in Homalotheciella and in *B. oxycladon*, and *B. acuminatum* and its allies, rarely or never plicate or strongly contracted under the mouth when dry; operculum conic, conic-apiculate or long-rostrate, seta often roughened with prominent papillæ, peristome perfect except in species having erect capsules.

Key.

1.	Leaves markedly papillose at back with projecting cell angles	*Bryhnia.*
	Leaves not papillose at back (somewhat so in *Pseudisothecium* and *Camptothecium* species)	2.
2.	Leaves strongly plicate	3.
	Leaves often concave with reflexed or recurved margins but rarely strongly plicate	5.
3.	Capsules erect and symmetric or nearly so; cilia of peristome rudimentary or wanting	*Homalothecium.*
	Capsules more or less curved and cernuous	4.
4.	Plants usually bright glossy yellow-green, often regularly pinnate	*Camptothecium.*
	Plants usually darker green, less glossy and seldom regularly pinnate	*Brachythecium* sp.
5.	Leaves very concave, spoon-shaped, abruptly long filiform-acuminate	*Cirriphyllum.*
	Leaves rarely so strongly concave or so slenderly acuminate, never both	6.
6.	Operculum long-rostrate; apical cells of branch leaves usually shorter and broader	*Eurhynchium* and *Rhynchostegiella.*
	Operculum conic to conic-rostrate; apical cells rarely much different	7.
7.	Capsules erect and symmetric or nearly so	8.
	Capsules more or less cernuous and curved	9.
8.	Calyptra hairy; segments adhering to the teeth of peristome	*Homalotheciella.*
	Calyptra smooth; peristome perfect, or cilia sometimes short or lacking	*Chamberlainia* and *Brachythecium* sp.
9.	Branches julaceous; leaves concave; leaf cells very long and narrow, 10–20 : 1; seta rough; all western	*Scleropodium.*
	Branches seldom julaceous; leaf cells usually shorter; seta smooth or rough	10.
10.	Leaves often slightly papillose at back; seta smooth; a large area of small thick-walled, rounded alar cells; rare and alpine in the East	*Pseudisothecium.*
	Leaves not papillose; seta often rough; alar cells much less numerous or enlarged, often thin-walled and clear; widely distributed	*Brachythecium.*

PSEUDISOTHECIUM nov. gen.

Isothecium Brid. Bryol. Univ. **2**: 255. 1827, in part.

Differs from Isothecium in its unsymmetric and cernuous capsules and peristomes with well developed cilia; from Eurhynchium in the scarcely rostrate operculum and larger area of rounded-quadrate angular cells, in this last it also differs from Brachythecium. Type species *P. myosuroides.*

While there is no doubt of the close relationship of the species here included and the European *Isothecium viviparum* (Neck.) Lindb. [*I. myurum* (Pollich.) Brid.], I have consistently held to the opinion that the erect capsule together with the absence of cilia in the peristome is a sufficient basis for generic distinction in the Hypnaceae.

Key.

Branches seldom flagelliform; branch leaves 1–1.5 mm. long; plants of eastern North America ..... *myosuroides.*
Branches often very long-flagelliform; branch leaves 1.5–2 mm. long; plants of the Pacific slope ..... *stoloniferum.*

Pseudisothecium myosuroides (Dill. L.) n. comb.

Isothecium myosuroides (Dill. L.) Brid. Bryol. Univ. **2**: 369. 1827.
Hypnum myosuroides tenue capsulis nutantibus Dill. Hist. Musc. 317, *pl. 41, f. 51.* 1741, and Herb.
Hypnum myosuroides L. Sp. Pl. 1130. 1753.
Eurhynchium myosuroides Schimp. Syn. Ed. 1: 549. 1860.

Plants in soft intricate light green to brownish green tufts; primary stems creeping, secondary stems 15–25 mm. long, suberect, dendroid and often stoloniferous, frequently becoming arcuate and giving off dendroid innovations like *Hylocomium proliferum;* branching subpinnate to fasciculate; branches often again divided; ultimate branchlets 5–8 mm. long, sometimes flagelliform and much lengthened; branch leaves somewhat secund, ovate-lanceolate to oblong-lanceolate, 1–1.3 × 0.25–0.35 mm., acute to long-acuminate, serrulate at apex, sometimes papillose at apex on the back by the thickening of the angles of the cell walls; costa extending to the middle or beyond, sometimes forking; median leaf-cells linear, 5–7 : 1; alar cells round-quadrate, incrassate; stem leaves triangular-ovate, long-acuminate, less strongly serrate, basal cells often thick-walled and brown; leaves of primary stems very small, distant, squarrose; paraphyllia none: inner perichaetial leaves with an ovate-lanceolate sheathing base and a long squarrose-recurved acumination, serrate above, costate. Dioicous. Seta smooth, twisted to the left above or often irregularly bent and twisted, 1.5–2 cm. long; capsule brown, oblong-ovoid, suberect, and slightly unsymmetric to horizontal and curved, 2–2.5 mm. long, 3–4 : 1; operculum conic, apiculate to short-rostrate; annulus of 2–3 rows of cells, easily deciduous; segments from a wide basal membrane, as long as the teeth, more or less split along the median line; cilia 2 or 3, nearly as long as the segments; spores minutely roughened, about 16 μ, maturing in autumn or early winter.

Type locality European; type at Oxford in the Dillenian herbarium.

In cool shady places on rocks and roots of trees in alpine and boreal regions. Rare in America. Trinity Bay, Newfoundland, Waghorne; Nova Scotia, James; White Mts. (North Conway) N. H., Oakes; Grandfather Mt., N. Carolina, Andrews.

Illustrations.—Dill. l. c.; Br. & Sch., Bry. Eur. *pl. 534; Pl. 3.*
Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 424.

Our eastern plant agrees very closely with the European *P. myosuroides,* but the western form referred to this species is quite different in a number of characters and I believe it should all be referred to *P. stoloniferum* (Hook). The only western specimen examined that seemed at all doubtful was from Guadalupe Island, Lower California, collected by Edward Palmer (no. 115) in 1875. The circumstances were such that the accuracy of this label is doubted. An exceedingly variable species especially in leaf characters.

Var. *filescens* Ren. & Card. is a slender form with branches often flagelliform. For the distinctions between this species and *P. stoloniferum* see notes under that species.

Pseudisothecium stoloniferum (Hook.) n. comb.

Isothecium stoloniferum (Hook) Brid. Bry. Univ. **2**: 371. 1827.
Hypnum stoloniferum Hook. Musc. Exot. **1**: pl. 74. 1818.
Eurhynchium stoloniferum Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876–77**: 347. 1878.

Hypnum myosuroides stoloniferum C. Muell. Syn. **2**: 500. 1851.
Hypnum spiculiferum Mitt. Journ. Linn. Soc. **8**: 34. 1865.
Hypnum acuticuspis Mitt., l. c.
Isothecium pleurozoides Kindb. Can. Rec. Sci. **1894**: 19. 1894.
Isothecium obtusatulum Kindb. Can. Rec. Sci. **1894**: 19. 1894. (Roell 117, Vancouver), fide Cardot, Hedwigia, **35**: 310. 1896.

Plants in wide, soft, loosely intricate tufts, light green to brownish green, often glossy; primary stems slender, long-creeping, radiculose, furnished with minute distant leaves; secondary stems dendroid, suberect, 5 cm. or more long, very much branched; branches two or three times divided, of varying length, often long-flagelliform, branches and branchlets inclined to one side; branch leaves varying greatly in habit, spreading to loosely imbricate when dry, sometimes subsecund, 1.5–2 × 0.3–0.4 mm., oblong-lanceolate to ovate-lanceolate, acuminate with point often twisted to the right, serrulate below, coarsely serrate above, smooth or papillose on the back by the thickened angles of the cell walls, margins often slightly revolute below; costa extending to the middle or beyond, often ending in a spine on the back; median leaf-cells linear, rather thick-walled, 7–10 : 1; alar cells round-quadrate, incrassate and indistinct; apical leaves of branchlets attenuate; leaves of creeping stems scale-like, 0.7 mm. long, narrowly acuminate, subdenticulate, costate to the middle; leaves of erect stems like those of creeping stems only larger with costa sometimes forking, gradually enlarged and elongated above, where they approach the branch leaves in shape and size; leaves of the flagella distant, slender, lanceolate, often very long-acuminate, serrate. Dioicous. Inner perichaetial leaves with broad sheathing bases and long-acuminate squarrose apices, serrate above or nearly entire; costa thin, sometimes wanting; paraphyses very numerous, long, composed of two or more rows of cells at base. Sporophyte much as in *P. myosuroides;* caspule ovoid, 2–2.5 mm. long, 2.5–3.1.

Type locality, western part of western North America; Menzies, 1787.

On the ground, trees, and rocks in woods. Apparently common on the Pacific coast. Alaska, Miss Cooley; Colorado, Shockley.

Illustrations.—Brid. l. c.; Hook. l. c.; *Pl. 3*.

Exsiccati.—Macoun Can. Musc. 292 in part, 291 (*Isothecium myosuroides*), 293 (*Hypnum spiculiferum*), 656 (*Isothecium pleurozoides*). Grout, N. Am. Musc. Pl. 57, 85a, 86, 87.

An exceedingly variable and perplexing species. The papillose character of the leaves is of no value whatever as a distinction, as the leaves of European *P. myosuroides* are frequently papillose and this character varies even on leaves of the same plant. I have seen type specimens of *Hypnum acuticuspis* Mitt. and *Hypnum spiculiferum* Mitt. The specimens of *H. spiculiferum* were larger and had larger, longer acuminate leaves on the secondary stems than is usually the case with *P. stoloniferum*, but there were two well-developed cilia with rudiments of a third. It appears to be a well-developed form of *P. stoloniferum*. *Isothecium pleurozoides* is a broad-leaved form varying in the direction of var. *myurellum*.

P. stoloniferum differs from *P. myosuroides* in its larger size, more frequent and better developed flagellate branches, in the longer branch leaves with a broader and more gradually narrowed acumination, and broader and longer median cells. The stem leaves also are slightly rounded at the basal angles, as broad as long and narrowed to a comparatively long slender acumination.

Var. Cardoti (Kindb.) n. comb.
Isothecium Cardoti Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Bright glossy yellow-green; secondary stems irregularly pinnately branching, 5–10 cm. long, sometimes bearing long rigid flagella at the ends; branch leaves reaching 3 mm. in length by 0.7 mm. in breadth.

Exsiccati.—Grout, N. Am. Musc. Pl. 49, 85; Allen, Mosses Cascade Mts. 111a, 111b, 112.

A beautiful variety representing the maximum development of the species. So large and striking is it in appearance that at first sight one feels that it must surely be a distinct species, but there is a whole chain of common and intermediate forms. The species itself is one of the most variable known to me, thus making it impossible to base a distinct species on a form whose principal difference is mere size. It is possible that *P. stoloniferum* itself should be regarded as a subspecies of *P. myosuroides*, but some specific lines seems imperative between such divergent forms as the European *P. myosuroides* and *Isothecium Cardoti* Kindb.

Type locality, Hastings, B. C. On base of trees and logs. Victoria, Vancouver Id.; Washington.

Exsiccati.—Macoun, Can. Musc. 394.

Var. myurellum (Kindb.) n. comb.
Isothecium myurellum Kindb. l. c.

Branches seldom flagelliform, having a much smoother subjulaceous appearance due to the shorter, more appressed leaves; branch leaves ovate-lanceolate to ovate-elliptical, obtusely acute to short-acuminate, 1–1.2 × 0.3–0.4 mm., coarsely, often doubly, serrate above, concave; median cells 5–7: 1, the upper shorter and broader; apical cells rhombic-elliptical, 2–3 : 1; round-quadrate alar cells more numerous.

On stones and decaying logs.

Type from Victoria and Nanaimo Rivers, Vancouver Island. Colorado, (Shockley); Vancouver Island, (Macoun); Marin and Sonoma Counties, California, (M. A. Howe).

Exsiccati.—Macoun, Can. Musc. 397, and 292 in part.

Illustrations.—*Pl. 2.*

By reason of its habit and short-pointed branch leaves with well differentiated apical cells, this variety also seems a good species at first sight, but all the intermediate forms of leaves can frequently be found in the same tuft and sometimes even on the same plant.

Cardot (Bull. Herb. Boissier 7: 340. 1899) came to the conclusion Hooker's type of *I. stoloniferum* was the form described by Kindberg as var. *Cardoti* and he proposed the name *substoloniferum* for the form commonly regarded as *I. stoloniferum*. As Cardot did not, as I understand it, see Hooker's type but only specimens he regarded as authentic, I hesitate to make the change until the type is consulted.

Cardot also states, l. c., p. 342 that *I. thamnoides* Kindb. Eur. & N. Am. Br. 36, is a var. of *stoloniferum*. (See notes under *Homalothecium Nuttalli.*)

BRYHNIA Kaurin, Bot. Not. 1892: 60. 1892.

(Named for the discoverer of the European representative of the genus, Dr. Nils Bryhn.)

Plants medium sized, in intricate mats or cushions, bright green on the surface, dirty brownish green below. Stems creeping, irregularly divided and branching; central strand present. Leaves concave, serrate, decurrent, conspicuously papillose on the lower surface by the greatly thickened angles of the cell walls; median leaf-cells short, 4–6 : 1, rather thick-walled; basal and alar cells a little larger and more nearly rectangular. *Sporophyte* much as in Brachythecium. Seta rough, twisted to the right; capsule short-oblong, somewhat arcuate; operculum long-conic to subrostellate; annulus present, well developed; cilia one or two, well developed, nodose.

The two species referred to this genus (previously known as *Eurhynchium Sullivantii* and *Brachythecium Novae-Angliae*) are undoubtedly very closely related and congeneric but the question of their further relationship is more difficult. They are seemingly intermediate between Brachythecium and Eurhynchium and were so regarded by the author of this genus. The shortness of the leaf-cells is a character that does not pertain to Brachythecium (except in the anomalous *B. reflexum* and *B. cyrtophyllum*). The thickening of the angles of the cell walls to form papillae is so distinct in no species of Brachythecium and is much more strongly marked than in any other species referred to Eurhynchium.

Key.

Branch leaves acute to short-acuminate, apex twisted ..... *Novae-Angliae.*
Branch leaves longer acuminate, apex not twisted ..... *graminicolor.*

Bryhnia Novae-Angliae (Sull. & Lesq.) Grout, Bull. Torr. Bot. Club 25: 229. 1898.

Hypnum Novae-Angliae Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 338. 1856. Sull. Mosses of the U. S. 76. 1856.
Brachythecium Novae-Angliae Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 338. 1878.
Hypnum scabridum Lindb. Bot. Not. 1887: 41. 1887.
Eurhynchium Novae-Angliae Kindb. Can. Rec. Sci. 1894: 23. 1894.
Hypnum (Cratoneuron) chloropterum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 231. 1892.

Plants in wide loosely intricate mats, bright green on the outside, dirty brownish green below, stems decumbent; secondary stems suberect, about 5 cm. long, subpinnately branching; branches erect-ascending, terete-foliate, often subjulaceous, 5–10 mm. long; branch leaves erect-open, loosely appressed-imbricate when dry, ovate to ovate-lanceolate, decurrent, 0.8–1.2 × 0.4–0.6 mm., serrulate, very concave, not plicate, papillose on the under side by the thickened angles of the cell walls, long-acute to short-acuminate; apex twisted one-half turn to the right; costa thick, extending beyond the middle of the leaf; median leaf-cells oblong-hexagonal, 5 : 1; alar and basal cells little differentiated, somewhat enlarged; stem leaves broadly ovate to triangular-ovate, 1–1.4 × 0.8–1.2 mm., nearly smooth, longer acuminate; leaf-cells shorter, areolation of decurrent angles somewhat more loose and more nearly rectangular; perichaetium about 2 mm. long; the leaves with sheathing bases and squarrose points; inner leaves oblong, long-filiform acuminate, somewhat serrulate above, costate. Dioicous. Seta dark red-brown, 1–2 cm. long, very rough with broad low papillae; capsule dark red-brown, almost black when old, oblong-cylindric, 3–3.5 mm. long, 4–5 : 1, somewhat arcuate, horizontal to suberect; operculum long-conic, subrostellate; annulus large; segments

nearly as long as the teeth; cilia one or two, nearly as long as the segments, strongly nodose; spores minutely roughened, 17–19 μ, maturing in autumn or winter.

Type locality, mountains of New England.

On earth and stones in wet shady places, especially in mountain regions. Northeastern United States and eastern Canada; south to Maryland; west to Pennsylvania.

Illustrations.—Sull. Icon. Musc. *pl. 118*. Limpr. Rab. Krypt. Pl. 4^3: 139, *f. 377* (*Bryhnia scabrida*). M. H. M. p. 288.

Exsiccati.—Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 338, (Ed. 2) 507; Aust. Musc. Appal. 329; Macoun, Can. Musc. 440; R. & C. Musc. Am. Sept. Exsic. 109; Grout, N. Am. Musc. Pl. 20.

Easily distinguished by its rostellate capsule, short papillose leaf cells and twisted leaf apices. The species varies considerably in length of the acumination of leaves so that var. *Delamarei* R. & C. Fl. Miq. 50, does not seem worthy of special mention, although I have not seen specimens of that form.

Var. fontinalis Grout, Bryologist **11**: 29. 1908.

Very slender and attenuate with leaves distant. (Grout, N. Am. Musc. Pl. 315.) Around cool spring under overhanging rocks. Pink Beds, Transylvania Co., North Carolina, Alt. 3500 ft. Type in herb. A. J. G.

The late D. A. Burnett sent me a peculiar form of this species from Bradford, Pa., growing on fine sand near the borders of a stream. The whole plant is much reduced and the leaves are more slenderly acuminate than usual.

Bryhnia graminicolor (Brid.) Grout, Bull. Torr. Bot. Club **25**: 231. 1898.

Hypnum graminicolor Brid. Spec. Musc. **2**: 251. 1812.
Hypnum praelongum var. Sull. Musc. Allegh. 44. 1845.
Hypnum Sullivantii Spruce, A. Gray, Man. Ed. 1. 1848.
Eurhynchium subscabridum Kindb. Ottawa Nat. **7**: 22. 1893.
Eurhynchium Sullivantii Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876.–77**: 354. 1878.

Plants slender, in closely intricate mats or cushions, pale-green to yellow-green, dirty-brownish green below, stems 1–2.5 cm. long, creeping, irregularly divided and branching, sometimes stoloniferous, sparingly radiculose, often brown and denuded of leaves; branches ascending, 5–10 cm. long, terete-foliate; branch leaves loosely imbricate to open erect, ovate-lanceolate, 0.6–0.8 × 0.25–0.3 mm., decurrent, acuminate, sharply serrate nearly to base, concave with margins reflexed below, strongly papillose by the thickening of the angles of the cell walls; median leaf-cells small, linear-oblong, 4–6: 1; quadrate alar cells few; stem leaves 0.75–1 × 0.4–0.45 mm., longer, and more slenderly acuminate: perichaetial leaves sheathing with spreading points; the inner oblong-lanceolate, abruptly long filiform-acuminate, distantly serrulate, often with traces of a costa. Dioicous. Seta 10–15 mm. long, red-brown, slightly twisted to the right, very rough with large crowded papillae; capsule red-brown, ovoid to subglobose, urn 1.5 mm. long and about two-thirds as broad; operculum short-rostrate, scarcely more than long-conic when moist, one-half length of urn; annulus present, easily detachable; teeth very slenderly pointed; segments shorter than the teeth, little or not at all split; cilia two, well developed, nodose; spores nearly smooth, 13–15 μ, apparently maturing in autumn.

Type locality, Pennsylvania, Muhlenberg. Type at Geneva.

On the ground or rocks in moist and shady places. New Brunswick to Minnesota, Illinois, and Georgia; Missouri, Bush.

Local and rarely fruiting. Reported from Vancouver Island, Roell, Hedwigia, **35**: 69. 1896, but probably a mistake.

Illustrations.—Sull. Icon. Musc. *pl. 105*. M. H. M., 289.

Exsiccati.—Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 291, (Ed. 2) 430; Aust. Musc. Appal. 334; Macoun, Can. Musc. 296; Grout, N. Am. Musc. Pl. 191, 191a, 257.

Distinguished from *B. Novae-Angliae* by its more slender habit, smaller and more slenderly acuminate leaves, which are much more strongly papillose.

Var. Holzingeri (R. & C.) Grout, l. c.

Eurhynchium Sullivantii Holzingeri R. & C. Bot. Gaz. **19**: 239. 1894.

More densely caespitose; branches shorter, generally obtuse; leaves broader, shorter acuminate.

Type locality in the District of Columbia, Coville. New Jersey, Best; Missouri, Demetrio.

This is the extreme variation in the direction of the characters noted above. The other extreme is reached in Drummond's Musc. Am. (S. States) 133 and R. & C. Musc. Am. Sept. Exsic. 196, which is more straggling and stoloniferous; branch leaves more distant and open, lanceolate, reaching 1 mm. in length

by 0.25 to 0.3 in breadth, long subfiliform-acuminate, very strongly dentate-serrate and very strongly papillose-roughened; stem leaves ovate-lanceolate, longer acuminate, reaching 1.3 mm. in length.

EURHYNCHIUM Br. & Sch. Bry. Eur., fasc. 57–61. 1854.

Plants well developed, never minute, green to yellow-green, growing in wide loose mats, or sometimes in dense tufts. Stems prostrate or creeping, more or less pinnately branched, sometimes closely and regularly pinnate, usually somewhat stoloniferous; central strand present in all the species. Branch leaves not complanate or secund, acuminate to obtuse, serrate, concave, more or less plicate; costa single, extending to the middle or beyond, usually ending in a spine underneath; median cells linear, 8–12 : 1, basal broader and shorter, alar quadrate or round, apical cells strongly differentiated and rhomboidal to circular in the group of *E. strigosum*. Stem leaves ovate, acute to slenderly long-acuminate. Paraphyllia sparingly present in some species. *Sporophyte* as in Brachythecium, except the operculum, which is very long-rostrate, equaling ½–⅓ the length of the urn.

The species of this genus are quite closely related to Scleropodium and Brachythecium, and it is difficult to give any general character, except the long-rostrate operculum, which distinguishes this genus from Brachythecium. It is distinguished from Scleropodium by the broader, shorter leaf-cells.

KEY.

1.	Apical cells of branch leaves oblong-rhomboidal to circular	2.
	Apical cells of branch leaves not differentiated	7.
2.	Seta rough	*hians* and *Rappii*.
	Seta smooth	3.
3.	Aquatic, growing on stones in streams	*rusciforme*.
	Terrestrial, usually growing on soil	4.
4.	Leaves erect-spreading	5.
	Leaves appressed-imbricate	6.
5.	Branch leaves 0.6–0.9 mm. long	*strigosum*.
	Branch leaves 1–1.5 mm. long, round-obtuse at apex	*fallax*.
6.	Alpine or boreal; usually in dense mats or cushions; slender	*diversifolium*.
	Lowland; in looser mats; more robust	*strigosum praecox*.
7.	Seta smooth or nearly so	8.
	Seta rough	9.
8.	Terete-foliate, western	*Brittoniae*.
	Complanate-foliate, eastern	*serrulatum*.
9.	Slender, variously branching; leaves not more than 1 mm. long	*praelongum*.
	Very robust, closely and regularly pinnate; branch leaves 1–1.5 mm. long	*oreganum*.

EURHYNCHIUM HIANS (Hedw.) Jaeger. & Sauerb., St. Gall. Nat. Gesell. **1876–77:** 357. 1878.

Hypnum hians Hedw. Sp. Musc. 272, *pl. 70, f. 11–14*. 1801.
Hypnum praelongum Hedw. St. Cr. **4:** 76, *pl. 29*. 1797.
Eurhynchium praelongum Br. & Sch. Bryol. Eur. fasc. 57–61. *pl. 8* (excl. var.). 1854.
Hypnum distans Lind. Musc. Scand. 34. 1879.

Plants in intricate, depressed mats, green to yellow-green, closely adherent to the substratum; stems 3–10 cm. long, creeping, strongly radiculose, little divided, extensively stoloniferous, irregularly to subpinnately branching; branches ascending, nearly simple, 3–12 mm. long; branch leaves erect-spreading, appearing complanate when dry, 0.8–1.1 × 0.5–0.7 mm., ovate, not decurrent, obtusely acute to short-acuminate with apex often twisted to the right, sharply serrate to the base, concave to nearly plane, sometimes appearing papillose by the thickening of the angles of the cell-walls; costa stout, extending ⅘–⅚ length of leaf, ending in a spine on the lower side of the leaf; median cells linear-oblong, 6–10 : 1; quadrate alar cells few, indistinct; apical cells rhombic, 2–3 : 1; leaves of stoloniferous stems small, 0.4–0.6 × 0.2–0.3 mm., ovate-lanceolate, rather abruptly narrowed into a slender acumination; costa thin and short; upper stem leaves much like branch leaves, short-acuminate; perichaetial leaves oblong-ovate, sheathing, rather abruptly narrowed to a long squarrose-recurved acumination, nearly ecostate, distantly dentate-serrate above. Dioicous. Seta 10–25 cm. high, dark red-brown, somewhat twisted to the right, very rough

with low rounded papillae; capsule a little lighter colored, inclined to horizontal, oblong-cylindric, curved, urn 2–2.5 mm. long, 3 : 1, little or not at all contracted under mouth when dry; operculum long-rostrate, three-fourths length of urn; annulus present, narrow, easily detached; segments nearly as long as teeth, more or less split; cilia usually 2, sometimes 3, strongly nodose; spores nearly smooth, 10–12 μ, maturing in late autumn.

On the ground in moist shady places. Canada to the Gulf of Mexico east of the Mississippi; Minnesota, Holzinger; Missouri, Bush.

Type locality, Pennsylvania.

Exsiccati.—Drumm, Musc. Am. (S. States) 134; Sull. Musc. Allegh. 53; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 290, (Ed. 2) 428; Aust. Musc. Appl. 335; R. & C. Musc. Am. Sept. Exsic. 118 (*E. praelongum*); Grout, N. Am. Musc. Pl. 194, 419.

Illustrations.—Sull. Icon. Musc. *pl. 104*, as *E. praelongum;* Hedw. l. c., Br. & Sch. l. c., as *E. Swartzii;* M. H. M. 290.

To sum up: There is a very great range of variation in several characters, especially in the width of the branch leaves and the length and slenderness of their acumination. The apex of the branch leaves of the European plant is slenderly acuminate in a larger proportion of cases than in the American, and the seta of the European plant averages longer.

E. hians is generally credited to Europe but the distinctions given by Limpricht will not hold*. If two species are to be made out of the European plants referred to *E. hians* and *E. praelongum* Hedw., the distinction will have to be based on different characters, one of which will, it seems to me, be the shape of the branch leaves. Our American plant differs considerably in this respect. Specimens from the Southern States have, as a rule, more slenderly pointed branch leaves, but there are all grades of intermediate forms and the difference is too slight to be of specific rank.

Eurhynchium Rappii (Williams) n. comb.

Oxyrhynchium Rappii Williams, Bryologist, **30**: 102. *pl. 8.* Nov. 1927.

Subspecies of *E. hians.* Loosely complanate-foliate; stem leaves broadly ovate-acuminate, reaching about 1.5 mm. long by 1 mm. broad; costa spinose at back in the upper part; annulus lacking; teeth of peristome with a furrow on the inner plates along the median line that gives the appearance of a pale median band. Type locality, Florida, S. Rapp. Probably occurring in other Gulf States. *Pl. 4.*

An extremely lax loosely complanate-foliate form. It will be interesting to know whether the lack of annulus and the pale median band of the teeth are accidental or are characteristic of this southern form.

Eurhynchium strigosum (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 519.* 1854.

Hypnum strigosum Hoffm., D. Fl. **2**: 76. 1796.
Hypnum thuringicum Brid. Musc. Recent. 2^2: 99. *pl. 3. f. 2.* 1801.
Hypnum pulchellum Hedw. Sp. Musc. 268. *pl. 68. f. 1–4.* 1801.
Hypnum velutinoides Voit. Musc. Herbip. 99. 1812.

Plants in wide loose mats, with a habit much like *Brachythecium velutinum*, green to yellow-green, stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately to subfasciculately branching; branches 3–8 mm. long, ascending or erect, terete-foliate, often appearing somewhat complanate-foliate when dry, attenuate at the ends; branch leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 0.7–1 × 0.3–.55 mm., acute or often obtuse, especially towards the ends of the branches, sharply serrate above, concave, little or not at all plicate; costa extending four-fifths length of leaf, ending in a spine underneath; median leaf-cells linear, 7–10 : 1; quadrate and oval alar cells few, apical cells conspicuously shorter and broader, oblong-rhomboidal, 2–3 : 1; stem leaves elongated triangular-ovate, more or less long-acuminate, somewhat decurrent, serrate, 0.9–1.2 × 0.4–0.6 mm.; apex often twisted half around to the right; leaves of the stoloniferous stems, triangular-ovate, abruptly long-acuminate, ecostate, 0.7–5 × 0.3 mm.; perichaetial leaves with sheathing bases and spreading points, oblong, narrowed to a slender subfiliform spreading acumination, ecostate, distantly serrate. Dioicous or pseudo-monoicous.

Seta 10–20 mm. long, red-brown, smooth, twisted to the right; capsule brown to red-brown, oblong-ovoid to oblong-cylindric, unsymmetric, inclined to horizontal; urn 2–2.5 : 1, constricted below mouth when dry; operculum ½–⅔ length of urn, abruptly long-rostrate; annulus of 2 or three rows of cells; segments nearly as long as teeth, split; cilia 2 or 3, nodose; spores 10–12 μ, nearly smooth, maturing in autumn.

* See Bull. Torr. Bot. Club **25**: 234–238.

Type locality, European.

On the ground, roots of trees, and decaying logs in woods and shady places; seemingly preferring steep shaded banks of ravines.

Ranging from Washington, British Columbia and Alaska to Labrador, south to the White Mountains, the Adirondacks, and the mountains of Colorado.

ILLUSTRATIONS.—Br. Sch. l. c.; Hedw. l. c.; M. H. M. 292.

EXSICCATI.—Grout, N. Am. Musc. Pl. 29, 361.

The leaves of this species and its relatives vary so in shape that any attempt to define species by the degree of acuteness of the leaves or other similar character seems futile.

Var. ROBUSTUM Röll, Hedwigia, **36**: 52. 1897.

Eurhynchium strigosum (in part) of American authors.

Plants with the habit of *Brachythecium plumosum*, in wide intricate mats, green to yellow-green; stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately or subfasciculately branching; branches 6–12 mm. long, ascending or erect, often fasciculately divided, terete-foliate, more blunt than in *E. strigosum;* leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 1–1.3 × 0.4–0.5 mm., usually acute; quadrate and oval alar cells confined to the extreme angles; stem leaves 1.2–1.5 × 0.4–0.6 mm., longer acuminate, acumination often subfiliform. *Sporophyte* rather larger than in the typical form.

Type locality, vicinity of Chicago, Illinois. Type duplicate in the herbarium of Columbia University.

Eastern Canada and in the United States from Louisiana to Minnesota and eastward. More abundant northward.

EXSICCATI.—(As *Hypnum strigosum.*) Drumm. Musc. Am. (S. States) 131; Sull. Musc. Allegh. 11; Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 292, in part, (Ed. 2) 431, in part; Aust. Musc. Appal. 332; Macoun, Can. Musc. 295; Grout, N. Am. Musc. Pl. 58.

The great majority of plants from eastern North America that have been referred to *E. strigosum* belong to this variety. Forms agreeing very closely with European *E. strigosum* are not rare in the United States and Canada, and are seemingly more frequent in elevated regions. Intergrading forms are very numerous, diversified, and extremely puzzling.

Var. PRAECOX (Hedw.) Husnot, Musc. Gall. 332. 1893.

Hypnum praecox Hedw. Spec. Musc. 249, *pl. 64.* 1801.

Plants caespitose or in looser intricate mats, green to yellow-green; stems creeping, 2–3 or even 8 cm. long, irregularly divided, subfasciculately branching, often stoloniferous; branches 3–6 mm. long, erect, julaceous, usually blunt; branch leaves crowded, imbricate-appressed when dry, erect-open when moist, cordate-ovate, more or less decurrent, 0.5–0.8 × 0.4–0.6 mm., almost acute to very obtuse and rounded at apex, serrate above, serrulate nearly to the base, more or less plicate, concave with borders often reflexed below; costa extending at least three-fourths the length of the leaf, ending in a spine underneath; median cells linear-oblong, 6–8 : 1; quadrate and oval alar cells numerous, apical cells rhomboidal to nearly circular; leaves of the stolons much as in *E. strigosum;* stem leaves acute to abruptly filiform-acuminate, triangular-ovate, decurrent, 0.8–1 × 0.6 mm., serrulate, costate to the middle. Seta 6–10 mm. long, capsule ovoid, unsymmetric, horizontal; urn 1.5–2 : 1, more or less contracted under the mouth when dry and empty; operculum two-thirds length of urn, convex, abruptly long-rostrate; cilia 1–3, strongly nodose; spores very finely roughened, about 12 μ, maturing in autumn.

"More depauperate than the species, tufts loose, deep green; stems shortened, thick and nearly naked; branches and branchlets erect, 3–5 mm. long; stem leaves 0.7 mm. long by 0.4 mm. broad, plicate; branch leaves close, appressed-imbricate, broadly ovate, short-acuminate, 0.6 mm. long by 0.3 mm. broad, margins somewhat reflexed above the middle, plicate; the upper branch leaves sometimes obtuse; leaf-cells 6 μ long, 10: 1, elongated in the acumination; costa extending three-fourths the length of the leaf, ending in a spine on the under side. Sporophyte like the species; seldom fruiting." *Limpricht, Rab. Krypt. Fl.* **4**^{2}: 159. 1897.

On shady banks, moist soil and rocks. New York, New Jersey, Pennsylvania; Texas, G. Jeremy.

Type locality, Sweden.

ILLUSTRATIONS.—Br. & Sch. Br. Eu. *pl. 519, f.* β.; M. H. M., p. 292.

EXSICCATI.—Drumm. Musc. Am. (S. States) 130 (*Leskea fasciculosa*); Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 293, (Ed. 2) 432; Aust. Musc. Appal. 333.

Distinguished from the species by the julaceous branches, appressed-imbricate leaves, more obtuse and more decurrent.

Var. SCABRISETUM Grout, Bull. Torr. Bot. Club **25**: 241. 1898.

Seta plainly scabrous with scattered papillae; otherwise like var. *praecox.*

On shaded ground.

Type in the Columbia Herbarium from the Palisades, N. J., Austin; Sargentsville, N. J., Best; Rensselaer Co., N. Y., E. C. Howe; Vineyard Haven, Mass., R. E. Schuh.

EXSICCATI: Grout, N. Am. Musc. Pl. 333.

In most sets of both editions of Sull. & Lesq. Musc. Bor.-Am. a portion of the specimen labeled *E.*

strigosum is smaller and has julaceous branches and in some sets of Ed. 1, a scabrous seta. This portion I should refer to var. *praecox* or var. *scabrisetum* as the case may be.

The roughening of the seta is a character not mentioned in any European work or observed in any European specimen, and is probably a new development.

As a rule the branch leaves of *E. fallax* are strongly decurrent, those of *E. strigosum praecox* and *E. diversifolium* somewhat so, while those of *E. strigosum* are usually not at all decurrent. The stem leaves of all these forms are more or less decurrent.

All the available literature on *E. strigosum*, *E. strigosum praecox* and *E. diversifolium* has been carefully studied to discover a satisfactory arrangement of the forms usually referred to these species. The result has been very unsatisfactory and the matter cannot be definitely settled until the types are compared with American material. The European material in the Herbarium of Columbia University indicates that the forms usually referred to *E. diversifolium* belong rather to *E. strigosum praecox* and accordingly this ground is taken provisionally. Limpricht's description of the variety *praecox* is copied and a full description of the American plant is given. Some discrepancies will be noted. Some of the American forms referred provisionally to var. *praecox* are more robust than any European material which has been examined. Limpricht says that the true *E. diversifolium* is a true alpine moss, "Ein echtes Hochalpenmoos," which the *E. diversifolium* of Lesq. & James and most other American authors is not.

In the mountainous and boreal regions of the northern United States and Canada west of the longitude of the Mississippi there is found an alpine moss which agrees very closely with Rabenhorst's Bryoth. Eur. No. 1143 (*E. diversifolium*), which is cited by Limpricht (l. c. 160). This western plant has been referred to *E. diversifolium*.

EURHYNCHIUM FALLAX (R. & C.) Grout, Bull. Torr. Bot. Club **25**: 242. May, 1898.

Eurhynchium strigosum var. *fallax* R. & C. Bot. Gaz. **14**: 98. *pl. 14, B.* 1889.
Eurhynchium substrigosum Kindb. Macoun, Cat. Can. Pl. 6: 205. 1892.

Plants in loosely intricate mats, robust, green to light yellow-green; stems 5–10 cm. long, procumbent, arcuate, ascending, often stoloniferous and rooting at the ends, giving off several secondary stems that bear comparatively few branches, branching irregular to subpinnate; branches 7–15 mm. long, terete-foliate, attenuate; branch leaves erect-open, usually long-decurrent, cordate-ovate to lanceolate-lingulate, 0.8–1.2 × 0.4–0.55 mm., rounded-obtuse, serrate above, serrulate to the base, concave, usually slightly plicate when dry; costa extending about seven-eighths the length of the leaf, ending in a spine underneath; median leaf-cells linear, 9–12 : 1; quadrate alar cells numerous; apical cells of various shapes, oblong-elliptical, elliptical, and circular; stem leaves larger and more narrowed at apex, 1.2–1.5 × 0.5–0.8 mm., only the lower and those of the stoloniferous stems acute or long-acuminate: perichaetial leaves with oblong sheathing bases, very abruptly narrowed to filiform erect-spreading acumination, the inner with a long thin costa, serrulate or entire. Monoicous. Seta red-brown, smooth, twisted to the right; capsule brown, oblong, unsymmetric, horizontal; urn 2.5 × 1 mm., little constricted below the mouth when dry and empty; operculum conic, abruptly long-rostrate, beak two-thirds length of urn; annulus present, of at least two rows of cells; cilia stout, 2 or 3, nodose to subappendiculate; spores minutely roughened, 10–13 μ, maturing in winter.

Type locality, on old logs, Lake Pend d'Oreille, Idaho, Leiberg.

On the ground, roots of trees and decaying logs. Northern United States and Canada, in the Rocky Mountain region. Alaska, O. S. Bates; British Columbia, Macoun; Idaho, Sandberg and Leiberg; Montana, Watson; Colorado, Wolf and Rothrock.

ILLUSTRATIONS.—R. & C., l. c.; *Pl. 4.*

EXSICCATI.—R. & C. Musc. Am. Sept. Exsic. 116; Grout, N. Am. Musc. Pl. 83, 83a; Macoun, Can. Musc. 449, in the Columbia Herbarium as *E. substrigosum* Kindb., is not this species, but appears to be *E. strigosum robustum*. Authentic material of *E. substrigosum* has been examined.

Distinguished from *E. strigosum robustum* by the more diffuse straggling habit, more distant leaves, branch leaves broad and rounded at apex, and less acute stem leaves; from *E. strigosum* and its other varieties, and the other closely allied species it is easily distinguished by its greater size and looser habit.

Var. BARNESII (R. & C.) Grout, l. c.

Eurhynchium strigosum var. *Barnesii* R. & C. Bot. Gaz. **14**: 98. 1889.

Stouter, with more slender, lingulate leaves which are also narrower at apex; capsule much larger and thicker.

Type locality the same as for the species.

Collected several times in Idaho by Sandberg and by Leiberg.

Var. TAYLORAE (Williams) Grout, Bryol. **5**: 41, May, 1902.

Eurhynchium Taylorae Williams, Bull. Torr. Bot. Club **29**: 66. 1902. *pl. 4.*

The extreme development in point of size of this extremely variable species. This form reaches nearly the size of *E. oreganum* but aside from size the leaf structure and form is not different from that figured by Cardot for *E. fallax*. The illustrations in Williams' plate illustrating the variety show the decurrent angles which are omitted in Cardot's drawings. The seta is very short and stout in the type.

Type, Leiberg's 172 from Traille River Basin, Idaho.

Exsiccati.—The largest plants in my N. Am. Musc. Pl. 83a.

Eurhynchium diversifolium (Schleich.) Br. & Sch. Bry. Eur. fasc. 57–61, *pl. 520.* 1854.

Hypnum diversifolium Schleich. in Herb. and Catal. 1807. (In part), *teste* Limpricht.
Eurhynchium strigosum var. *diversifolium* Molendo & Lorentz, Flora. 1867.

Plants caespitose or in thick, densely intricate mats, green to yellow-green; stems 2–7 cm. long with long thick stolons, creeping, densely radiculose, sending up numerous fasciculately divided branches; branches short, 2–5 mm. long, julaceous, blunt; branch leaves appressed-imbricate, ovate, acute or rounded-obtuse, 0.5–0.6 × 0.36–0.45 mm., serrulate, concave, excavate at the slightly decurrent angles; costa extending four-fifths length of leaf, often ending in a spine underneath; median leaf-cells linear to linear-oblong, 5–8 : 1, apical rhomboidal or nearly circular; area of quadrate alar cells much larger than in any of the allied species; stem leaves ovate, acute to long-acuminate, decurrent, 0.8–1 × 0.6–0.75 mm.; leaf-cells narrower and longer, apical cells not differentiated; costa seldom ending in a spine; leaves of stoloniferous stems varying greatly in size on the different parts of the stolon, slightly open, without chlorophyll, elongated-triangular, narrowly long-acuminate; excavate at the angles, very long and narrowly decurrent; costa slender or wanting; perichaetial leaves sheathing at base, with spreading acumination, oblong-ovate, abruptly long-acuminate; costa thin or wanting. "Dioicous or pseudo-monoicous." Seta 5–10 mm. long, red-brown, smooth, twisted to the right; capsule red-brown, ovoid to short-oblong, unsymmetric and inclined; 1.5 : 1, slightly contracted under the mouth when dry; operculum long-rostrate, nearly as long as the urn; "annulus of two rows of cells, persistent"; segments from a basal membrane one-third the length of the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14–18 μ, maturing in winter.

Type locality, European. Type at Kew.

On the ground and rocks in mountainous and boreal regions of western North America, especially in the Rocky Mountain region. Ohio, *fide* Schimper, l. c.; S. Dakota, M. A. Thompson.

Illustrations.—Br. & Sch. l. c.; Limpricht, Rab. Krypt. Fl. 4^3, *f. 34; Pl. 4.*

Exsiccati.—Macoun, Can. Musc. 500; Grout, N. Am. Musc. Pl. 425, Musci Perfecti 83.

Limpricht, l. c., describes the branch leaves as round-obtuse with the costa seldom reaching three-fourths of the length of the leaf, but Rabenhorst's Bryotheca Europea, 1143, which he cites, agrees with the American material in these respects as well as in the dimensions of the leaf-cells. It seems pretty certain that our American plant here referred to *E. diversifolium* agrees with Limpricht's idea of this species and it certainly agrees with the accessible European exsiccati. While resembling *E. strigosum praecox* in many ways it can be readily distinguished by its slender habit, smaller branch leaves and more numerous quadrate alar cells.

Eurhynchium praelongum (Dill. L.) Bryhn, Explor. Bryol. in Valle Norv. Stördalen, 59. 1893. (*fide* Limpricht).

Hypnum praelongum L. Sp. Pl. 1125. 1753. (Non Hedw. St. Cr. 4: 76. *f. 29.* 1797.)
Eurhynchium pseudospeciosum Kindb. Can. Rec. Sci. 1894: 22. 1894.
Hypnum Royae Aust. Bot. Gaz. 3: 31. 1878.
Eurhynchium acutifolium Kindb. Rev. Bryol. 22: 84. 1895.

"Stems (in the type) slender, prostrate, elongated (2–5 inches), divided; at intervals rather regularly pinnate, with slender, somewhat attenuated, often curved, not very crowded, subcomplanate branches; forming low, somewhat straggling masses of a bright or dull green, less commonly yellowish. Stem-leaves distant or more rarely crowded, widely cordate-triangular or widely ovate-cordate, rapidly or even abruptly and longly acuminate in a long often almost filiform, squarrose acumen; at base wide, excavate, strongly decurrent; margin plane, regularly and distinctly denticulate, nerve slender, reaching above half-way and usually into the acumen; cells linear, slightly vermicular, tapering but obtuse, 10–18 times as long as wide, pellucid; towards base wider and shorter, lax, at angles large, subrectangular, but not forming clearly defined auricles. Paraphyllia occasionally, but not always present. Branch leaves much narrower, widely or even narrowly lanceolate, gradually acuminate, very acute, somewhat erect when dry, more spreading when moist, not complanate, moderately soft in texture and often twisted when dry, not plicate, hardly glossy. Perichaetial bracts squarrose, very longly acuminate. Seta rather long, often one inch. Capsule turgidly ovate, narrower when ripe and empty, horizontal, abruptly passing into the seta at base, rather large; lid subulate-rostrate, usually decurved, almost as long as the capsule. Dioicous."

The above excellent description is copied from Dixon and Jameson's Handbook of British Mosses, p. 416. The species is rare in America and Mr. Dixon has had a much better chance to become acquainted with it, as it is common in England.

Type locality European.

On soil and decayed stumps.

California, Bolander, no. 83; Olema, San Mateo Mts.; White Mts., N. H.; Oregon, Vancouver Island, Washington.

ILLUSTRATIONS.—Dixon & Jam. Handb. Brit. Mosses, *pl. 54 A.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 433, (*Hypnum Stokesii*). Also sent out by Macoun as No. 100 of his Canadian Cryptograms under the name of *Eurhynchium pseudospeciosum.* Canadian Musci 442 (*E. hians* ?); Grout, N. Am. Musci Pl. 53. 167.

There has been an almost endless amount of confusion as to the nomenclature of this plant. Wilson, Mitten, Dixon and Lindberg have applied the name to one plant, and Hedwig, Schimper, Husnot, Limpricht, and Cardot to another. The plant of Lindberg and the British bryologists is very closely allied to *E. Stokesii*, indeed, the latter appears to be only a variety of it. The *E. praelongum* of Hedwig and Schimper is identical with our *E. hians.* Now the two species that have borne this name are utterly and entirely distinct and could not be confused by the veriest tyro. The decision as to what is the true *E. praelongum* must rest with the Dillenian plant on which Linnaeus founded *Hypnum praelongum.* Lindberg saw the plant in Dillenius' herbarium and declares that it is the plant that the British bryologists have called *E. praelongum.* As Lindberg was an acute observer and has the best possible grounds for his opinion, I have followed him. One reason for the continuance of the confusion is the fact that the true *E. praelongum* is rare on the continent and in America and when found has nearly always been referred to *E. Stokesii.*

E. praelongum is distinguished from its variety *Stokesii* by its less robust, more straggling appearance, less rigid stems, fewer paraphyllia and less regularly pinnate and less bipinnate branching. There is not the difference between the relative dimensions of the leaf-cells that is indicated by the two descriptions. I think Mr. Dixon's figures are too large. The leaves of the species are frequently more distant than those of the variety and the branches are much fewer in number.

Specimens of *Rhynchostegium Royae* (Austin) R. & C. collected in California by James and named by Austin, in the herbarium of the N. Y. Botanical Garden seem to be *E. praelongum* although they are too depauperate and scanty to make sure.

Var. STOKESII (Turn.) Dixon l. c.

Hypnum Stokesii Turn. Musc. Hiber. 159. *pl. 15. f. 5.* 1804.
Eurhynchium Stokesii Br. & Sch. Bryol. Eur. fasc. **57–61.** *pl. 526.* 1854.

Plants in wide intricate mats, green to light yellowish green; stems rigid, procumbent, often stoloniferous, irregularly divided; 10–13 cm. long, sparingly radiculose, sending up suberect secondary stems which are closely and regularly pinnate, often bipinnate and 2–3 cm. long; branchlets slender, 3–13 mm. long, teretefoliate; branch leaves erect-open, decurrent, ovate-lanceolate, acuminate, 0.7–0.8 × 0.45 mm., smaller at the apex of the branches and on the smaller branchlets, serrate above, serrulate to the base; angles of the cell walls very slightly papillose-thickened; costa extending three-fourths length of leaf, often ending in a spine underneath; median cells oblong-linear, 5–8 : 1, broader and shorter at the decurrent angles; stem leaves distant, squarrose, strongly decurrent, triangular-ovate, abruptly and slenderly long-acuminate, 0.7–0.9 × 0.9–1.3 mm., serrate (entire on some of the stoloniferous portions), basal cells thicker walled, quadrate alar cells more numerous than in the branch leaves; paraphyllia borne sparingly on the stems (Dixon *l. c.* describes the paraphyllia as numerous), leaf-like, triangular-ovate to ovate-lanceolate: perichaetial leaves ovate with sheathing bases, abruptly narrowed to a long slender squarrose acumination, strongly dentate-serrate, ecostate. Dioicous. Seta 2–3 cm. long, red-brown, stout, twisted to the right, very rough with large blunt papillae; capsule oblong-ovoid, red-brown, slightly unsymmetric, horizontal, slightly contracted under the mouth when dry; urn about 2 mm. long, 1.5–2 : 1; operculum long-rostrate, nearly as long as urn; annulus large, easily detachable; segments nearly as long as the teeth; cilia 2 or 3, nodose; spores 10–14 μ, maturing in late autumn or early winter.

Type locality, Ireland.

On the ground and roots of trees, west of the Rocky Mountains in the northern United States and Canada, Idaho, Washington, Oregon, California, Vancouver Island, British Columbia. Apparently common within this range. Newfoundland (*fide* Cardot).

ILLUSTRATIONS.—Turner, l. c.; Br. & Sch. l. c.; *Pl. 5.*

EXSICCATI.—Macoun, Can. Musc. 297; R. & C. Musc. Am. Sept. Exsic. 119; Grout, N. Am. Musc. Pl. 110, 239; Musci Perfecti 30.

Our American plant is as a rule considerably stouter than the European and more regularly pinnate, varying towards *E. oreganum*, which is most certainly a derivative of it. One of the best characterized of these forms is

Var. CALIFORNICUM Grout, l. c.

Gametophyte with the habit of a *Thuidium;* stems 15–20 cm. long, closely and regularly pinnate, seldom stoloniferous, more robust throughout; leaves of the maximum size.

Type from California, Bolander no. 46. 1876. In the herbarium of Columbia University.

EURHYNCHIUM BRITTONIAE Grout, Bull. Torr. Bot. Club 25: 248. May, 1898.

Plants in wide intricate mats, dark green; stems creeping, radiculose, 5–10 cm. long, sparingly divided; branching closely and regularly pinnate; branches 5–10 mm. long, terete-foliate; branch leaves open-erect, 0.7–0.9 × 0.3–0.4 mm., gradually long-acuminate, lanceolate to ovate-lanceolate, serrate to the base, slightly or not at all decurrent; leaf-cells oblong-linear, 5 : 1, alar quadrate; costa extending four-fifths the length of the leaf, often ending in a spine underneath; stem leaves deltoid-ovate, 1.8 × 1 mm., including the filiform acumination which is 0.5–0.8 mm. long, serrulate at base, nearly entire above, strongly excavate at the decurrent angles; quadrate and rhomboidal alar cells numerous; perichaetial leaves sheathing at base, ovate to oblong-ovate, with a long-filiform squarrose acumination, ecostate, distantly spinose-toothed on the margins above. Seta 1.5–2 cm. long, red-brown, twisted to the right, nearly or quite smooth; capsule oblong-cylindric, unsymmetric and horizontal; urn 1.5 mm. long, 2 : 1, contracted below the mouth when dry; operculum long-rostrate, at least two-thirds the length of the urn; annulus?, segments from a basal membrane which is at least two-thirds the height ot the teeth; segments split between the articulations; cilia 2 or 3, strongly nodose; spores finely roughened, about 15 μ.

Type from California, Bolander. Specimens of this species of Bolander's California collections are in the National Museum from "Little River (Mendocino Co.?) at the foot of pine tree, no. 332." Also in the herbarium of Mr. J. M. Holzinger as no. 530.

This species is very closely related to *E. praelongum californicum* and greatly resembles it in appearance but is easily distinguished by its nearly smooth seta and nearly entire stem leaves.

Named in honor of Mrs. E. G. Britton.

EURHYNCHIUM OREGANUM (Sulliv.) Jaeger. & Sauerb. St. Gall. Nat. Gesell. 1876-77: 361. 1878.

Hypnum oreganum Sull. Mem. Am. Acad. 4: 172. 1849.

Plants in wide loose mats; yellow-green above, brownish green below the surface; stems procumbent, densely radiculose at points of contact with substratum, 6–25 cm. long; sparingly divided, closely and regularly pinnate, often bipinnate; branches 1.3–2.5 cm. long, terete-foliate, tapering; branch leaves open-erect, decurrent, broadly cordate-ovate, 1–1.5 × .75–1 mm., acuminate, sharply serrate above, serrulate to base, somewhat concave and slightly plicate; costa stout, extending nearly to base of acumination, ending in a spine at the back; median cells linear, about 7.1; extreme alar cells thick-walled, oblong to rhomboidal; stem leaves larger, reaching 2 × 1.3 mm., more broadly ovate, longer acuminate: dioicous; male branches abundant; perichaetial leaves sheathing at base with reflexed points, ovate to oblong-ovate, abruptly long and slenderly acuminate, ecostate, sharply dentate-serrate. Seta 2–2.5 cm. long, red-brown, twisted to the right, very rough with high blunt papillae; capsule lighter colored, horizontal to slightly drooping, unsymmetric, oblong-ovoid, 2–2.5 mm. long, 2 : 1, slightly contracted under the mouth when dry and deoperculate; operculum a little shorter than urn; annulus present, well developed, of at least two rows of cells, easily detachable; segments as long as the teeth, more or less split between the articulation; cilia 2–3, well developed, nodose to short-appendiculate; spores 15–20 μ, nearly smooth, maturing in winter

On the ground, decaying logs and base of trees. California, Oregon, Washington, Vancouver Id., Idaho, British Columbia.

ILLUSTRATIONS.— Sulliv. Bot. Wilkes Expd. Musc. 16. *pl. 13, B; Pl. 5.*

EXSICCATI.—Sull. & Lesq. Musc. Bor.-Am. (Ed. 2) 434; Macoun, Can. Musc. 298; R. & C., Musc. Am. Sept. Exsic. 120; Grout, N. Am. Musc. Pl. 5.

A beautiful species, closely allied to *E. Stokesii;* easily distinguished from that and other species by its large size and regularly pinnate branching.

EURHYNCHIUM RUSCIFORME (Neck.) Milde Bryol. Siles. 312. 1869.

Hypnum rusciforme Neck. Delic. Gall.-Belg. 2: 481. 1768.

Rhychostegium rusciforme Br. & Sch. Bry. Eur. fasc. 49–58. *pl. 9.* 1852.

Platyhypnidium rusciforme Fleisch. Laubmfl. Java 4: 1537. 1922.

Plants in large robust tufts, usually dark green, dirty green or almost black below; stems prostrate, woody, often very long and denuded of leaves; branches suberect in most cases, or more nearly straight and parallel with the stem, rigid and harsh to the touch when dry; leaves open-erect when dry, scarcely decurrent, reaching 2.4 by 1 mm., broadly ovate, slightly concave with plane margins, acute to almost obtuse, denticulate nearly to the base; costa very thick at base, reaching one-half to three-fourths the length of the leaf,

often ending in a spine at back; median cells linear, 8–15 : 1, rather thick-walled, at base and apex shorter. Seta smooth; capsule light to dark brown, oblong-ovoid, somewhat contracted under the mouth when dry; beak long and slender, often curved; spores maturing from August 15 to October 15.

ILLUSTRATIONS.—Bry. Eur. l. c.; M. H. M. 293.

EXSICCATI.—Sull. Musc. Allegh. 46, 47 (as *Hyp. riparoides* and var.); Sull. & Lesq. Musc. Bor. Am. 297; Aust. Musc.Appal. 347; Macoun, Can. Musc. 301, 326 and 482, 659 as varities; Grout, N. Am. Musc. Pl. 39; Musci Perfecti 123.

Very common in brooks, especially in elevated regions, either submerged or on rocks wet by spray and submerged only during high water. As this species fruits freely it is easily determined if collected in the autumn. In gross appearance it resembles *Hypnum dilatatum* somewhat, but the costate leaves, which are not nearly so orbicular, and the long-rostrate operculum render it easy to distinguish between them. There is a wide range of variation in size and acumination of leaves, the apex sometimes being much more slender than figured. The habit of the plant is also variable, ranging from the form figured to soft slender almost floating forms.

When I wrote my monograph on Eurhynchium (Bull. Torr. Bot. Club, May, 1898), I hesitated about including Rhynchostegium, but after a longer acquaintance and more complete study I can see no reason whatever for a separate genus. Certainly as far as American forms are concerned the distinctions between Eurhynchium and Rhynchostegium are very hard to find and still harder to define.

EURHYNCHIUM SERRULATUM (Hedw.) Kindb. Can. Rec. Sci. **1894**: 22. 1894.

Hypnum serrulatum Hedw. Spec. Musc. 238. *pl. 60.* 1801.
Rhynchostegium serrulatum Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876–77**: 370. 1878.

Plants growing in wide loose thin mats over humus in woods, chlorophyll green, scarcely glossy, flattened, with the appearance of a Plagiothecium; branch leaves distant, about 2 mm. long, plane margined, serrate, slightly concave, somewhat contorted when dry but scarcely striate or plicate, ovate-lanceolate, long-acuminate, strongly serrulate above; median cells linear-vermicular, 7–10 : 1, basal and alar somewhat broader and shorter, no specially differentiated alar cells; costa rather thin, usually reaching well above the middle of the leaf, sometimes shorter; stem leaves cordate-triangular, more abruptly and narrowly acuminate with a much more slender point, slightly serrulate above; alar cells more differentiated; seta smooth; capsules contracted under the mouth when dry and empty, urn about 2 mm. long, operculum long and narrowly beaked; spores maturing from September 1 to October 15.

ILLUSTRATIONS.—Sull. Icones Musc. *pl. 107*; M. H. M. 294.

EXSICCATI.—Sull. Musc. Allegh. 57; Sull. & Lesq. Musc. Bor. Am. 436; Drumm. Musc. Am. (S. States) 118; Aust. Musc. Appal. 346; Macoun, Can. Musc. 456; Grout, N. Am. Musc. Pl. 152.

Frequent but almost sure to be mistaken for a Plagiothecium, unless in fruit or studied microscopically. Sterile it might be mistaken for *B. Starkei* or *B. rutabulum*. From the former it differs in the narrower leaves with the alar cells of its stem leaves much less conspicuous. From certain forms of the latter it would be well-nigh indistinguishable without the sporophyte. When the sporophyte is present, the smooth seta and the small *lighter colored* capsule afford a ready means of distinction even if the operculum has fallen.

DOUBTFUL SPECIES.

EURHYNCHIUM DAWSONII Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Plants in thin intricate mats, dirty green, branches tipped with bright somewhat glossy green leaves; branch leaves loosely intricate, slightly or not at all decurrent, ovate, more or less long-acuminate, concave, serrulate above, margins slightly reflexed at base, 1–1.2 × 0.5 mm.; costa very stout, extending four-fifths length of leaf; median cells oblong-linear, 6–8 : 1; area of quadrate alar cells large. Sporophyte not seen.

Described from a specimen bearing this label, "On stones in ditch west side of Black's Hotel, Hastings, B. C., April 29, 1889."

Resembling *E. crassinervum* in the stout costa, broad leaf-cells and numerous quadrate alar cells; differing in the slender habit and smaller ovate branch leaves.

The following is the original description:

"Stems densely pinnate, not or rarely radiculose; branchlets patent. Leaves green or brownish, not glossy, not or indistinctly papillose, not long-acuminate from the broad ovate base, recurved on the borders below, long-decurrent, open-erect, denticulate all around, areolation variable, often sub-rhomboidal; costa thick, reaching nearly to the apex. Probably dioicious."

"Allied to *E. hians* and *E. Sullivantii*."

"On rocks along the Nanaimo River below the railway bridge, Nanaimo, Vancouver Island, April 27, 1887."

EURHYNCHIUM CRASSINERVUM (Tayl.) Br. & Sch. var. LAXORETE Kindb. Macoun, Cat. Can. Pl. **6**: 207. 1892.

"Differs in the leaves being nearly entire or faintly denticulate above, shorter acuminate and the cells larger. Only male flowers found."

"On earth in woods at Canaan Forks, Queen's county, New Brunswick. J. Moser."

No specimens available and original description quoted.

RHYNCHOSTEGIELLA (Br. & Sch.) Limpr. Laubm. **3**: 207. 1896.

Small mosses of damp places. Distinguished from Eurhynchium by the diminutive size of both gametophyte and sporophyte.

RHYNCHOSTEGIELLA CURVISETA (Brid.) Limpr. l. c., 211. Dec. 1896.

Hypnum curvisetum Brid. Spec. Musc. **2**: 111. 1812.

Plants very slender; leaves lanceolate, long-acuminate, costate to the middle, concave, serrate at apex, 1–1.2 mm. long by 0.24–0.30 mm. wide; median leaf cells linear, 8–10 : 1, a few basal shorter and broader. Monoicous. Seta 5–8 mm. long, rough; capsule about 1 mm. long; operculum rostrate; spores in winter.

The above description has been adapted from Limpricht. No American sporophytes have been seen and it is possible that none have been found. James' specimens have leaves 1.5 mm. long with the acumination ⅓ of this. The median leaf cells reach 50 μ long by 4 μ wide and the lower leaf margins are slightly recurved yet they seem too close to the European plant to be considered a separate species. The only other collection that I have found besides that at Fairmount Park, Philadelphia, is one by Andrews in North Carolina. I am hazarding the guess that the plant rarely fruits in America and is so small that it is overlooked or discarded as trash.

ILLUSTRATON.—Bry. Eur. *pl. 509* (as *Rhynchostegium Teesdalei*). *Pl. 14.*

CIRRIPHYLLUM Bull. Torr. Bot. Club **25**: 222. May, 1898.

Plants very robust, glossy, growing on earth and rocks, occasionally on roots of trees; stems possessing a well differentiated central strand, prostrate or creeping, irregularly or subpinnately branching, branches julaceous, terete-foliate. Leaves imbricate, *very concave, spoon-shaped, rounded and often cucullate at apex, abruptly drawn out into a long filiform acumination*, costate to the middle or beyond; median leaf-cells linear, 10–15 : 1; basal broader and shorter; alar often quadrate. *Sporophyte* as in Brachythecium except that the operculum is usually long-rostrate.

The plants referred to this genus certainly have no closer genetic relationship with those retained to represent *Eurhynchium* than with several other genera. The rostrate operculum is the only character which would link the two in one genus. Lindberg transferred the European representatives of this genus to the division Rhynchostegium of the genus Hypnum, while Kindberg places them all in Brachythecium. The gametophyte characters of several species are certainly more like Brachythecium than Eurhynchium. The resemblance between *C. Tommasinii* and *Brachythecium albicans* is certainly very striking, and robust forms of the latter have been taken for the former. Consequently it seems far more satisfactory to constitute the following species a separate genus, far better characterized than many of the allied genera, also more distinct and more homogeneous.

KEY.

1.	Leaves with a very long filiform acumination	2.
	Leaves shorter acuminate, apex twisted	*Boscii.*
2.	Apex of branch leaves strongly cucullate at base of the acumination	3.
	Apex of branch leaves not cucullate at base of acumination	4.
3.	High alpine mosses growing on stones; costa of stem leaves very short	*cirrosum.*
	Lowland mosses growing on the ground and roots of trees; costa of stem leaves extending ⅔ their length	*piliferum.*
4.	Acumination 0.3–0.4 mm. long; median leaf-cells 3–4 : 1	*Brandegei.*
	Acumination 0.5–0.8 mm. long; median leaf-cells 8–12 : 1	*cirrosum coloradense.*

CIRRIPHYLLUM CIRROSUM (Schwaegr.) Grout, l. c. 223.

Hypnum cirrosum Schwaegr. Schulte's Reise auf d. Glockner, 365. 1804.
Brachythecium cirrosum Schimp. Syn. Ed. 1: 696. 1860.
Eurhynchium Vaucheri var. *julaceum* Br. & Sch. Bryol. Eur. fasc. 57–67, *pl. 530.* 1854.
Myurium (?) *Herjedalicum* Schimp. Syn. Musc. 696. 1860 (*fide Juratzka*).
Eurhynchium cirrosum Husnot, Musc. Gall. 338. 1893.

Plants in bright glossy yellow-green mats; primary stems creeping, irregularly branching; branches 5–10 mm. long, julaceous; branch leaves appressed-imbricate, decurrent, oblong-ovate, not including acumination 1.3 × 0.65 mm., entire or serrulate above, abruptly narrowed to a filiform acumination (which is serrulate to nearly entire, 0.5 mm. long), concave and spoon-shaped, cucullate at base of acumination; margins somewhat reflexed below; costa short, extending from ⅓–½ length of leaf, sometimes divided or branching; median cells 10–12: 1; alar quadrate to hexagonal, indistinct; stem leaves ovate, body of leaf 1.8–2.4 mm., acumination 0.6–1 mm. long, area of quadrate-hexagonal alar cells much larger; costa very short, median leaf-cells somewhat shorter: perichaetial leaves ecostate, serrate at apex, abruptly narrowed into a long-filiform squarrose serrate acumination. Dioicous. Seta 15 mm. long, twisted to the right, rough with blunt papillae; capsule ovoid, unsymmetric, horizontal, with operculum 2 mm. long, 2–1, chestnut-brown, not contracted under the mouth when dry; operculum sharply conical, not rostrate; annulus* not highly differentiated, segments split between the articulations; cilia 2, strongly nodose; spores 18–20 μ, finely roughened.

Description of sporophyte adapted from Limpricht, Rab. Krypt. Fl. 4³: 183. 1897.

Growing on rocks in mountains. Colorado; Pike's Peak; Skagway, Alaska, with capsules, Williams. Type locality, European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 97;* Limpricht, Rab. Krypt. Fl. 4³: *f. 386;* Dixon & Jameson Handb. Brit. Mosses, *Pl. 53, f. G; Pl. 6.*

Our American specimens are less robust and shorter stemmed than most of the European material at hand and the stems are not stoloniferous or the branches flagelliform as is usually the case with European specimens, yet some European plants agree almost exactly with the American plant and the two are almost certainly the same species. *C. cirrosum* is a very variable and poorly understood plant even in Europe.

Var. COLORADENSE (Aust.) Grout, l. c., 224.

Hypnum coloradense Aust. Bot. Gaz. 2: 111. 1877.

Plants robust; stems 3–5 cm. long, erect or at length prostrate, sparingly branched; leaves loosely imbricate, oblong-ovate, 2–2.2 × 0.9 mm. without the acumination, which is 0.5–0.8 mm. long, nearly entire, abruptly long-filiform acuminate but not at all cucullate, much less concave than in the typical form, somewhat plicate.

Type locality, Alma, Park Co., Colorado, Miss H. J. Biddlecome. Type in the herbarium of Columbia University.

Distinguished by the stout, sparingly branched stems and loosely imbricate leaves which are not cucullate at apex. It does not correspond with any of the European varieties mentioned by Limpricht so far as can be determined from the material at hand. It is clear that Austin did not know the true *cirrosum* for there is a specimen of it from Colorado labelled in Austin's handwriting, "*Hypnum coloradense var. dimidio minus, sericeo-aureo viride, caule subjulaceo tereti.*"

CIRRIPHYLLUM BRANDEGEI (Aust.) Grout, l. c. 224.

Hypnum Brandegei Aust. Bot. Gaz. 3: 31. 1878.

Plants densely caespitose, yellow-green; stems erect, 3–4 cm. high, nearly simple, terete-foliate, obtuse; leaves loosely appressed-imbricate, not decurrent, ovate, abruptly subulate-acuminate to filiform-acuminate, 2 × 0.9 mm. (acumination 0.3–0.4 mm. long) entire, concave, plicate; margins plane; costa reaching the middle of leaf, sometimes forking; median cells oblong-linear, 25–30 × 9 μ; basal cells shorter and broader; alar enlarged-quadrate. *Sporophyte* unknown.

Type locality, Colorado, Brandegee. Type in the Columbia University Herbarium.

Easily distinguished from *C. cirrosum* by its caespitose habit, short entire acumen and much looser areolation.

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* Mrs. Britton, March, 1897, in specimens collected in Algau by Molendo (Herb. Jaeger), found the annulus to consist of 3 rows of very irregular and persistent cells.

Cirriphyllum piliferum (Schreb.) Grout, l. c., 225.

Hypnum piliferum Schreb. Spicil. Flor. Lips. 91. 1771.
Eurhynchium piliferum Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 531*. 1854.

Plants in wide loose mats, glossy, bright yellowish-green; stems long, sometimes reaching 20 cm., creeping, irregularly divided, pinnately branching, sparingly radiculose; branches rather distant, 10–15 mm. long, terete-foliate; branch leaves loosely erect, imbricate, decurrent, ovate, very concave and spoon-shaped, the rounded apex abruptly narrowed into a long-filiform acumination, 1.2 × 0.8 mm., smaller near ends of branches; acumination one-half length of the body of leaf; apex cucullate, margins strongly serrate, more nearly or quite entire at base; costa fully two-thirds length of body of leaf; median leaf-cells linear, 10–15 × 1; alar cells abruptly enlarged and inflated; stem leaves larger and more broadly ovate, 1.5–2 × 1 mm. (2–2.5 × 1–1.2 mm. according to Limpricht), enlarged and inflated alar cells more numerous: perichaetium sheathing, the leaves ovate, somewhat abruptly narrowed to a very long slender erect-spreading acumination, somewhat serrulate, ecostate or some of the inner slightly costate. Dioicous; male plants somewhat smaller. Seta 2–3 cm. long, dark red-brown, twisted to the right, very rough with low blunt papillae; capsule red-brown, inclined to horizontal, oblong-ovoid, arcuate; urn 2.5 mm. long, 2–3 : 1; operculum nearly as long as the urn, long-rostrate from a conic base; annulus of at least two rows of cells, detachable; teeth of peristome very slender-pointed, very strongly papillose-roughened above; segments nearly or quite as long as the teeth, slender, split between the articulations; cilia 2 or 3, long and very slender, nodose to subappendiculate; spores smooth, 12–16 μ, maturing in winter or early spring; sporophyte rare.

Type locality, European.

On the ground and base of trees in woods and shady meadows, most frequently on steep springy shaded banks of rivulets, often closely interwoven with other mosses; New Brunswick, New Hampshire, Vermont, New York, New Jersey, Pennsylvania, Ohio, Washington.

Illustrations.—Br. & Sch. l. c.; Hedw. Musc. Frond. 4: 35, *pl. 14*, 1794; Husnot, Musc. Gall. *pl. 97;* Dixon & Jam. Handb. Brit. Mosses, *pl. 53, f. K; Pl. 6.*

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 290^b, (Ed. 2) 492; Austin, Musc. Appal. 336; Grout, N. Am. Musc. Pl. 120.

Infrequent or else overlooked because of its sterility.

Our American plant is much less robust than the European.

Cirriphyllum Tommasinii (Sendt.) Grout l. c. (*Hypnum Vaucheri* Schimp. not Lesq.) has been several times reported from America but I have been unable to find any American specimens of this species in any of the herbaria seen. *Brachythecium albicans* has been reported as this species and very likely forms of *C. cirrosum* may have been referred here.

Cirriphyllum Boscii (Schwaegr.) Grout, l. c. 226.

Hypnum Boscii Schwaegr. Suppl. 1: 223. 1816.
Hypnum illecebrum Hedw. Spec. Musc. 252. *pl. 66* (excl. varieties). 1806.
Eurhynchium Boscii Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 361. 1878.
Myurium Boscii Kindb. Can. Rec. Sci. 1894: 73. 1894.

Plants in thick soft loosely intricate cushions, or in loose thin mats, on the ground among the grass, glossy, golden-yellow to brownish-yellow; stems creeping or ascending, irregularly divided and branching; branches and shorter stems suberect, turgid, terete-foliate; stems often stoloniferous and subpinnately branching, sparingly radiculose, 5–15 cm. long; branches 1–3 cm. long, the longer more or less subdivided; branch leaves erect-open when moist, loosely imbricate when dry, decurrent, scarious, broadly ovate, very concave, spoon-shaped, 2–2.5 × 1.4 mm., serrate to the middle; apex rounded and abruptly acuminate, acumination twisted one-half turn to the right; basal angles rounded, subauriculate; costa extending three-fourths length of leaf; leaf-cells thick-walled, the median linear, 6–10 : 1, basal and apical shorter and broader, the alar not differentiated; leaves of the stoloniferous stems much smaller, less abruptly narrowed to the longer acumination, costa shorter; stem leaves less concave, less abruptly acuminate, acumination longer, less frequently twisted: apparently dioicous, male branches not seen; perichaetial leaves with oblong-ovate sheathing bases, abruptly narrowed to a filiform spreading acumination, ecostate and entire or toothed below base of acumination. Seta 1.5–3 cm. long, red to red-brown, smooth, slightly twisted to the right; capsule brown, inclined, unsymmetric to arcuate, gradually narrowed into the seta, oblong, strongly arcuate and contracted under the mouth when dry, with operculum 3–4 × 1 mm.; annulus of at least two rows of

cells; operculum conic, long-rostrate, about one-half the length of urn; segments as long as the teeth, split between the articulations; cilia 2 or 3, well developed, nodose; spores nearly smooth, 16 μ, maturing in autumn.

Type locality, North America; collected by Bosc, probably in South Carolina. Type in the Boissier Herbarium at Geneva.

On the ground and rocks in shady places and open fields. Vermont to Florida and Louisiana, west to Missouri and Illinois; more abundant southward. The only specimen I have seen from Canada was of Drummond's collection and was in Prof. Macoun's collection as from "Upper Canada." Prof. Macoun suggests that it may have been from Niagara Falls.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 106.* M. H. M. 295.

EXSICCATI.—Drumm. Musc. Am. (S. States), 132; Sulliv. Musc. Allegh. 42; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 2) 435, (Ed. 1) 294; Austin, Musc. Appal. 331; R. & C. Musc. Am. Sept. Exsic. 117; Grout, N. Am. Musc. Pl. 352; Musci Perfecti 24.

A very striking and easily identified moss, but one which is unique in many respects and whose relationships are obscure.

The relationship of *Hypnum Boscii* to the other species referred to Cirriphyllum is somewhat less marked than the relationship between the other species of that genus, but it is closer than the relationship between *H. Boscii* and any other genus known to the author.

CHAMBERLAINIA nov. gen.

(In honor of the late Edward B. Chamberlain.)

Resembling the salebrosum group of Brachythecium. Differing in the erect symmetric and cylindrical capsules; also in lacking cilia in the peristome. The area of quadrate alar cells is rather larger and these cells rather more clear. *Brachythecium splendens* is an intermediate form but as it has a well-developed cilium, it is left in Brachythecium.

KEY.

1. Plants as robust as *Brachythecium oxycladon*, and much resembling it when sterile.... *acuminatum.*
   Plants more slender..... 2.
2. Median leaf cells of branch leaves 4–8 : 1..... *cyrtophyllum.*
   Median leaf cells of branch leaves 10–13 : 1..... *biventrosum.*

CHAMBERLAINIA ACUMINATA (Hedw.) n. comb.

Brachythecium acuminatum (Hedw.) Kindb. Can. Rec. Sci. **1894:** 72. 1894.
Leskea acuminata Hedw. Sp. Musc. 224. *pl. 56.* 1801.
Leskea setosa Hedw. Sp. Musc. 226. *pl. 57.* 1801.
Leskea Beyrichii Hampe., Linnaea, **13:** 47. 1839.
Hypnum acuminatum C. Muell. Syn. **2:** 334. 1851.
Hypnum erectum Drumm. Musc. Am. 224.
Homalothecium acuminatum Jaeger & Sauerb. St. Gall. Nat. Gesell. **1877-1878:** 309.

Plants in wide, rather densely caespitose tufts, green to glossy yellow-green; stems creeping, radiculose, primary branches erect or ascending, 1–3 cm. long, sparingly divided, somewhat radiculose, often with radiculose tips; branchlets unequal, tapering, subjulaceous, terete-foliate; branch leaves erect-imbricated, open, appressed when dry, lanceolate to ovate-lanceolate, somewhat decurrent, 1–1.6 × 0.4–0.6 mm., acuminate, more or less serrate above, concave, somewhat plicate; margins often somewhat revolute; costa extending above middle; median cells linear to oblong-rhomboidal, 5–9 : 1; marginal cells broader; basal enlarged, quadrate; leaves of main branches deltoid ovate, broader: dioicous; male branches borne on the stem, gemmiform; perichaetium 2–2.5 mm. long; leaves loosely erect, the inner ovate-lanceolate to oblong-lanceolate, long-filiform acuminate, distantly dentate above, costate nearly to middle. Seta 1.5–2 cm. high, red-brown, smooth; capsule brown, cylindric, erect or very slightly curved, varying greatly in size, 1.5–3 mm. long; operculum conic to short-rostrate; annulus none; teeth of peristome united at base, lanceolate, with slender hyaline papillose-roughened points, red-brown below, margined; segments linear-lanceolate from a narrow basal membrane, slightly papillose-roughened above, about the length of the teeth; cilia very rudimentary or none; spores minutely roughened, 12–16 μ, maturing in autumn.

Type locality, Lancaster, Pa. (Muhlenberg).

On decaying wood, bases of trees, rocks and earth, in woods or shady places. Eastern North America, west to Minnesota, south to the Gulf; not rare.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 116;* M. H. M. 284.

EXSICCATI.—Drumm. Musc. Am. (S. States) 124 (*Leskea setosa* var.); 125 (*L. setosa*), 126 (*L. acuminata*); Sull. Musc. Allegh. 72; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 330, (Ed. 2) 491, 492 and 493; Austin, Musc. Appal. 310; Macoun, Can. Musc. 282; Grout, N. Am. Musc. Pl. 116.

This species is very variable in width of basal membrane, width of segments, shape of leaves and length of acumination, but no one of these variations seems to be correlated with any other.

Hedwig's type has lanceolate branch leaves, becoming broadly lanceolate below; basal membrane of medium width; the plants are small and slender, leaves serrulate above and more contracted at base than usual. The form ordinarily distributed as the species corresponds to Hedwig's *setosa*, but the two cannot be distinguished except as extreme forms of one species. The leaf of *acuminata* figured by Hedwig must be a stem leaf, as the branch leaves of his type are lanceolate.

Var. RUPINCOLA (Sull. and Lesq.) n. comb.

Hypnum acuminatum rupincolum Sull. and Lesq. Mosses of North America, 336. 1884.
Leskea rupincola Hedw. Sp. Musc. 227. *pl. 54.*

Characterized by an extremely narrow basal membrane. Probably having the range of the species but found most frequently in the southeastern United States.

Var. FILIFORME E. G. Britton, Mem. Torr. Bot. Club, **4**: 185. 1893, is not a Brachythecium.

CHAMBERLAINIA CYRTOPHYLLA (Kindb.) n. comb.

Brachythecium cyrtophyllum Kindb. Ottawa Nat. **4**: 63. 1890.

Plants caespitose; tufts glossy-green, usually densely intricate; stems irregularly divided and branching; branches filiform, subjulaceous, 5–10 mm. long; branch leaves open-erect, appressed-imbricate when dry, ovate to ovate-lanceolate, acute or short acuminate, 0.7 × 0.3 mm., serrulate, very concave; margins reflexed below; costa extending ⅔–¾ length of leaf; median cells fusiform, 4–8 : 1; many basal cells shorter and broader; quadrate alar cells numerous; stem leaves broadly ovate, acuminate, 0.7 × 0.4 mm.; median leaf-cells 3–5 : 1. Dioicous. Seta and capsule much as in *C. acuminata* but the capsule narrower, peristome similar.

Type locality, Brighton, Northumberland Co., Ontario, October 6, 1888 (Macoun). Type seen.

Roots of trees and old logs. Waterloo, N. Y., Austin, 602; *Hypnum* (*Brachythecium*) *julaceum* sp. nov. (Ms. notes in Austin's herbarium.) Frequent in the North Central States, south to N. Carolina.

EXSICCATI.—Aust. Musc. Appal. 311 (*Brachythecium acuminatum* var. *setosum*); Grout, N. Am. Musc. Pl. 115, 359.

ILLUSTRATION.—M. H. M. 285.

Closely allied to *B. acuminatum*, distinguished by its filiform stems and branches and small leaves with shorter cells.

CHAMBERLAINIA BIVENTROSA (C. Muell.) n. comb.

Brachythecium biventrosum C. Muell. Bull. Torr. Club **5**: 49. 1874.

Plants loosely caespitose, light-green, small and slender; stems creeping, subpinnately branching; branches slender, 3–8 mm. long, julaceous, terete-foliate; branch leaves appressed-imbricate, lanceolate to narrowly ovate-lanceolate, gradually narrowed to a long slender point, serrulate with small distant teeth, concave with margins recurved or bisculcate at base; costa extending ⅔ the length of the leaf; median cells linear, 10–13 : 1; basal cells shorter and broader; alar quadrate, indistinct; inner perichaetial leaves sheathing at base, more or less abruptly narrowed into a filiform reflexed acumination, dentate above, ecostate. Dioicous. Seta 10–15 mm. long, red-brown, smooth; capsule red-brown, oblong, about 1.8 mm. long and less than half as thick, erect and symmetric; operculum conic, apiculate; annulus lacking; segments of peristome attached to a narrow basal membrane, split between the articulations; cilia single, rudimentary.

Type specimen on trunks and roots of trees in woods near Baton Rouge, La. (Dr. Joor). (Type seen; specimens examined by Mueller were communicated to the Columbia Herbarium by Dr. Mohr).

C. biventrosa is closely allied to *C. acuminata*, from which it is distinguished by its smaller size and by its very narrowly pointed leaves with fewer and indistinct alar cells.

Ill. M.F. I Pl. 126B

BRACHYTHECIUM Br. & Sch. Bryol. Eur. 1851.

Plants mostly of medium size and typically hypnaceous habit, very rarely pinnately branching with any degree of regularity. Branch leaves acute to acuminate, never obtuse, usually somewhat concave and often plicate or sulcate, costate to above the middle; median leaf cells sinuous-linear to linear-rhomboidal (broader and shorter in *B. reflexum*, *B. digastrum* and in some leaves of *B. cyrtophyllum*), basal cells broader and shorter, alar quadrate, rarely inflated and hyaline.

Stem leaves notably different in most species, larger and proportionately broader, often more slenderly acuminate and less strongly serrate; seta smooth to very rough, twisted to the right, capsules short-ovoid to oblong-ovoid, cernuous-arcuate and 2–4 : 1 (cylindric in *B. oxycladon* and nearly erect and symmetric in *B. splendens*), slightly contracted under the mouth when dry and empty; operculum conic to short rostrate; peristome characteristically hypnaceous and perfect. When in fruit this genus is easily recognized in most cases by the short, thick, dark-colored capsules, which are usually unsymmetric and horizontal; spores almost without exception maturing in late autumn or early winter.

The grouping of species given below is a little different from that given in my monograph of the genus, in Vol. VI of the Memoirs of the Torrey Botanical Club, but represents opinions based on a great deal of additional study.

(1) The Salebrosum group consisting of *B. salebrosum*, *B. flexicaule*, *B. acutum*, *B. campestre*, *B. oxycladon*, *B. digastrum*, *B. albicans*, *B. pseudocollinum*, *B. turgidum*, *B. glareosum*, *B. Wootonii*, *B. beringianum*, *B. edentatum* (?), *B. Roteanum* and *B. splendens*.

This group is characterized by smooth seta (except *B. campestre*), leaves plicate or sulcate when dry (except *B. acutum*), slenderly acuminate, concave and excavate at basal angles with the margins turned back parallel to the plane of the leaf (or reflexed in the ordinary descriptive language) in the lower portion; basal cells broader and shorter, quadrate alar cells numerous, hyaline or slightly chlorophyllose, stem leaves ovate-lanceolate; annulus poorly developed, fairly well developed in *B. acutum*.

(2) The Rutabulum group including *B. rutabulum*, *B. rivulare*, *B. Washingtonianum*, *B. asperrimum*, *B. lamprochryseum* and *B. Nelsoni*, characterized by rough setae, well-developed annulus, ovate-deltoid stem-leaves with leaves less concave and alar cells less numerous, except in *B. rivulare* and *B. Nelsoni*.

(3) Reflexum group including *B. reflexum*, *B. glaciale*, *B. Starkei* and *B. pacificum* characterized by triangular-ovate decurrent leaves which are not plicate.

(4) The Plumosum group including *B. plumosum* and *B. populeum*, characterized by rough setæ and densely chlorophyllose quadrate alar cells.

(5) The Velutinum group including *B. velutinum*, *B. erythrorrhizon*, *B. Thedinii*, *B. Leibergii*, *B. collinum*, *B. utahense*, *B. Bolanderi* and *B. petrophilum*, characterized by small size and in our species by somewhat secund leaves.

Key.

1.	Costa extending to the apex in most leaves	2.
	Costa ending below apex	4.
2.	Seta very rough throughout	3.
	Seta rough above only. (sometimes smooth)	*populeum.* 24
3.	Plants very slender; leaf cells 3–5 : 1	*reflexum.* 25
	Plants more robust; leaf cells 8–10 : 1	*Bestii.* 27 W
4.	Branch leaves entire*	5. W or Arc
	Branch leaves serrulate to strongly serrate	6.
5.	Slender; mostly dioicous	32. W
	Very stout; leaves loosely appressed-imbricate; monoicous	*turgidum.* 13
6.	Seta smooth throughout	7.
	Seta more or less roughened with papillae	17.
7.	Capsules erect and symmetric	8.
	Capsules more or less unsymmetric and cernuous; cilia well developed	9.
8.	Southern. Capsules 3 mm. long; cilia single, well developed	*splendens.* 7
	Northwestern. Capsules not more than 2 mm. long; cilia rudimentary or wanting	*utahense.*

* *B. acutum* and *B. plumosum* often have some of the branch leaves entire.

9.	Capsules 3–4 : 1, cylindric, suberect. (See *digastrum.*)	10.
	Capsules 2–3 : 1, strongly unsymmetric and cernuous	11.
10.	Enlarged basal and alar cells numerous, quadrate to oblong-hexagonal; monoicous. Southern	*Roteanum.*
	Quadrate alar cells less numerous and smaller; dioicous. Northern	*oxycladon.*
11.	Stem leaves gradually and evenly narrowed from base to slender apex	12.
	Stem leaves acuminate, i. e. less rapidly narrowed near apex than below	14.
12.	Plants robust; stem leaves at least 1.8 mm. long	13.
	Plants more slender; stem leaves seldom more than 1.5 mm. long	*pseudocollinum.*
13.	Stem leaves lanceolate, 0.6 mm. broad	*flexicaule.*
	Stem leaves slenderly triangular-ovate	*acutum.*
14.	Branch leaves mostly more than 1.5 mm. long	15.
	*Branch leaves mostly 1 mm. long or less	16.
15.	Dioicous; western or subalpine	31.
	Monoicous; common, rare west of the Great Plains; leaves not falcate-secund	*salebrosum.*
16.	Stem leaves broadly ovate; plants robust	*digastrum.*
	Stem leaves ovate-lanceolate; plants slender	*collinum.*
17.	Seta slightly roughened with small or distant papillae	18.
	Seta rough above, nearly smooth below	19.
	Seta roughened throughout with large papillae†	20.
18.	Stems short, irregularly branching; monoicous	*collinum.*
	Stems long and slender, pinnately branching; dioicous	*Thedenii.*
19.	Leaves plicate, long-acuminate	*campestre.*
	Leaves not plicate, shorter acuminate	*plumosum.*
20.	Enlarged inflated alar cells numerous	21.
	Alar cells scarcely or not at all inflated, often smaller and subquadrate	22.
21.	Inflated cells extending nearly or quite to costa; plants of the Rocky Mountain region	*Nelsoni.*
	Inflated cells confined to the angles; common	*rivulare.*
22.	Branch leaves falcate-secund	23.
	Branch leaves rarely if ever falcate-secund	24.
23.	Stem leaves lanceolate	*velutinum.*
	Stem leaves ovate to ovate-lanceolate	*Leibergii.*
24.	Lower stem leaves strongly auriculate	*Washingtonianum.*
	Leaves not auriculate	25.
25.	Plants slender	26.
	Plants robust	27.
26.	Costa extending to base of acumen, sometimes nearly percurrent	*Bestii* and *glaciale.*
	Costa extending little beyond the middle	*petrophilum.*
27.	Leaves strongly plicate	28.
	Leaves little or not at all plicate	29.
28.	Plants less robust; leaves more decurrent and more strongly serrate	*asperrimum* and *subasperrimum*
	Plants more robust; leaves slightly or not at all decurrent and serrulate	*lamprochryseum*
29.	Leaves 0.6–9.8 mm. long; dioicous	*Bolanderi.*
	Leaves usually more than 1.5 mm. long	30.
30.	Monoicous; yellow-green; not complanate	*rutabulum.*
	Dioicous; dark green; usually somewhat complanate in American forms	*Starkei.*
31.	Leaves falcate-secund	*erythrorrhizon.*
	Leaves not falcate-secund	*Wootonii.*
32.	Leaves lax, spreading; alar cells abruptly enlarged and inflated	*edentatum.*
	Leaves closely imbricated or appressed; alar cells not inflated	33.

* *B. erythrorhizon suberythrorrhizon* may be sought here.

† *B. petrophilum* sometimes has the seta rather slightly roughened.

33. Stem leaves with long slender acumination ..... *albicans.*
Stem leaves abruptly short-acuminate ..... *beringianum.*

1. BRACHYTHECIUM SALEBROSUM (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 549.* 1853.

Hypnum salebrosum Hoffm. Deutschl. Fl. **2**: 74. 1795.
Hypnum plumosum salebrosum C. Muell. Syn. **2**: 359. 1851.
Brachythecium laevisetum Kindb. Bull. Torr. Bot. Club **17**: 279. 1890.

Plants in wide glossy yellow-green mats; stems 5 cm. or more long, creeping and radiculose, irregularly to subpinnately branching; branches terete-foliate or seldom complanate-foliate; branch leaves lanceolate, 1.8–2.3 × 0.5–0.65 mm., long-acuminate, serrate above, concave, with margins reflexed; costa extending beyond the middle; median cells linear-vermicular, 10 : 1; basal cells much shorter and broader; alar quadrate, thin-walled; stem leaves ovate-lanceolate, nearly entire, 2–2.5 by 0.8–1.1 mm.; perichaetium 2 mm. long; the leaves sheathing at base with spreading points; the inner rather abruptly narrowed into a long filiform acumination, entire or distantly serrate above; costa nearly obsolete. Monoicous. Seta 1–2 cm. long, red-brown, smooth; capsule red-brown, 2.5–3 mm. long, 2.5–3 : 1, oblong-ovoid, usually strongly arcuate and horizontal; operculum conic-apiculate; annulus very narrow and inconspicuous, often remaining attached to the operculum; teeth of peristome red-brown below; segments nearly as long as the teeth; cilia 2, well developed, nodose or subappendiculate; spores nearly smooth, 15 μ, maturing in autumn or early winter.

Type locality European.

On earth, stones, roots and trunks of trees, and rotting wood in woods and moist shady places. Eastern Canada and northern and eastern United States; less frequent west of Minnesota and Nebraska; south to North Carolina.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 272.
EXSICCATI.—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 328, (Ed. 2) 487; Austin, Musc. Appal. 312 and 313; Macoun, Can. Musc. 283, 438 (*Hypnum acutum*); Grout, Musci Perfecti 26, 112; N. Am. Musc. Pl. 127, 218.

Distinguished from *B. oxycladon*, which it closely resembles, by being monoicous; by the shorter and more curved capsules and the more distant and open leaves, having a looser basal areolation; branch leaves also more slender-pointed. The capsules are very variable in length, sometimes almost exactly resembling those of *B. oxycladon.* An extremely variable species as at present understood.

A great variation in the appearance of the dried specimens appears to be due to the conditions of drying. Herbarium specimens with the leaves widely spreading and somewhat complanate, upon being wet and dried again took on the appearance that is characteristic of the species, the branches becoming terete-foliate and the leaves much more closely appressed, but there are straggling loosely foliate forms well represented by

Var. FLACCIDUM Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 550.* 1853.

Plants in wide loose dark green mats; stem and branches slender; branch leaves distant, spreading, more or less complanate, strongly serrate, apex often twisted; stem leaves very broadly triangular-ovate, approaching in outline those of *B. Starkei*, about 2 × 1.2 mm., very slenderly acuminate, slightly serrulate. Peristome with cilia often 3. Capsule much like that of *B. oxycladon.*

New Brunswick; Weehawken, N. J., and Oneida, N. Y. *B. salebrosum flaccidum* is the extreme broad-leaved form of the species and may be distinct, but at present our knowledge is insufficient to define it.

2. BRACHYTHECIUM FLEXICAULE R. & C. Mem. Torr. Bot. Club 6^2: 167. 1897.

Plants in wide loosely intricate mats, yellow-green, often brown underneath; stems creeping, densely radiculose, closely applied to the substratum, 5–12 cm. long, subpinnately branching; branches 5–10 mm. long, terete-foliate, ascending, attenuate; branch leaves narrowly lanceolate, 2–2.5 × 0.5–0.65 mm., gradually narrowed to a very long slender apex, serrate, concave at base; margins somewhat reflexed; costa extending ½–⅔ length of leaf; median cells linear-vermicular, 12–14 : 1; basal cells broader and shorter; extreme alar cells subquadrate. Monoicous. *Sporophyte* usually not to be distinguished from that of *B. salebrosum;* capsule sometimes approaching that of *B. oxycladon*, 3–4 : 1. M. H. M. 274.

Type locality, John's Beach, Newfoundland, (Waghorne). On earth, Revelstoke, B. C. (Macoun, sent out as *B. glareosum*); on schistose rocks, Manchester, Vt.; New Jersey; on decaying wood, Bradford, Pa.; Adirondacks.

Type seen.

This species seems to me to be almost identical with *B. salebrosum densum* Br. & Sch. Bryol. Eur. *pl.*

550, but M. Cardot thinks otherwise. It is easily distinguished from all its near allies by the extremely narrow stem leaves, gradually narrowed from just above the base to the apex.

3 BRACHYTHECIUM ACUTUM (Mitt.) Sull. Icon. Musc. Suppl. 99. *pl. 75*. 1874.

Hypnum acutum Mitt. Journ. Linn. Soc. **8**: 33. *pl. 6*.
Brachythecium mammilligerum Kindb. Macoun, Cat. Can. Pl. **6**: 192. 1892.

Plants in wide thin glossy-green to yellowish-green mats; stems prostrate, creeping or sometimes floating, 5–10 cm. long, irregularly divided, radiculose at base, branching irregularly pinnatifid; branches few, 5–10 mm. long, frequently somewhat complanate-foliate, not radiculose; branch leaves distant, open, lanceolate to ovate-lanceolate, gradually narrowed from just above the base, ending in a very slender point, 1.6–2 × 0.5–0.7 mm., distantly serrate or entire, very slightly concave, little or not at all plicate; costa extending two-thirds the length of the leaf; median cells linear-vermicular, 10 : 1; basal and alar cells shorter and broader, oblong-rhomboidal to quadrate; stem leaves slender-pointed, triangular-ovate, nearly entire, 2–2.5 by 1 mm.; perichaetium 2.5 mm. long; the inner leaves ovate-lanceolate, sheathing at base, open above, abruptly long-filiform acuminate, ecostate. Monoicous, sometimes polygamous. Seta 2.5–3.5 cm. long, smooth, red-brown, often lighter colored above; capsule red-brown, oblong-ovoid to short-cylindric, 3 mm. long, 3 : 1, arcuate and inclined, occasionally nearly symmetric; operculum long-conic, apiculate; annulus simple, of 1 or 2 rows of cells; teeth of peristome subulate-lanceolate, orange; segments nearly as long as teeth; cilia 2 or 3, well developed, strongly nodose or appendiculate; spores minutely roughened, 13–15 μ, maturing in autumn.

Type seen, from Pack River, British Columbia (Lyall in Mitten herbarium). On the ground and rotting logs in moist and swampy places. Northern United States and Canada, across the continent; south to N. J., Ohio and Colorado.

ILLUSTRATIONS.—Mitt. l. c.; Sull. l. c.; M. H. M. 278.
EXSICCATI.—Austin, Musc. Appal. 316; Macoun, Can. Cryptogams 110 (*B. salebrosum mammilligerum*); Grout, N. Am. Musc. Pl. 213, 292, 447.

A careful comparison of a large number of specimens indicates that this species is distinct from the European *B. Mildeanum* Sch. The aspect of the plant is different in that it has loosely foliate and rather flaccid branches, while *B. Mildeanum* has more robust, densely foliate, turgid branches. The leaves are long, slender-pointed, more like *B. glareosum* than *B. Mildeanum*. Sullivant's figure resembles *B. Mildeanum* more closely than *B. acutum*. Mitten's figure represents the leaf much more accurately. Austin's Musc. Appal. 316, is, however, more like *B. Mildeanum* and Sullivant's figure and may prove to be distinct. There seems to be a complete series of intergradations between this species and *B. salebrosum*. The gradually tapering stem leaves which are seldom plicate and the more slender-pointed and less serrate branch leaves are the characters most easily recognized.

4 BRACHYTHECIUM CAMPESTRE Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 545*. 1853.

Hypnum rutabulum campestre C. Muell. Syn. **2**: 368. 1851.
Brachythecium subalbicans De Not. Cronaca, **2**: 20. 1867. Epil. 118. 1868.

Plants in wide loose dark green to glossy yellow-green mats; stems 5 cm. or more long, decumbent or ascending, often stoloniferous at the ends; branch leaves equally spreading to somewhat falcate-secund, lanceolate to ovate-lanceolate, 1.4–2 × 0.4–0.6 mm., long-acuminate, strongly serrate above, concave, costate to the middle or beyond; median cells linear-vermicular, 10–12 : 1; basal cells shorter and broader; alar quadrate; stem leaves ovate-lanceolate, less strongly serrate, long subfiliform-acuminate, 2 × 0.6–1.1 mm., strongly plicate; perichaetium 2–2.5 mm. long; leaves sheathing at base, with squarrose points; inner leaves oblong-lanceolate, rather abruptly narrowed into a long-filiform serrate acumination, costate. Monoicous. Seta 1–2 cm. long, red-brown when old, more or less roughened with rather low distant papillae, nearly smooth below; capsule red-brown, 2.5–3 mm., 3 : 1, unsymmetric and inclined; operculum long-conic, apiculate; annulus narrow, usually adhering to the operculum; cilia 1 or 2, long, nodose and papillose-roughened; spores roughened, 15 μ, maturing in autumn.

Type locality European.

On damp earth and stones, in woods and in damp grassy places. Apparently has the range of *B. salebrosum*. As yet no specimens have been reported from farther south than New Jersey. Quesnelle, B. C. (Macoun).

ILLUSTRATIONS.—Br. & Sch. l. c.; *Pl. 8*.
EXSICCATI.—Aust. Musc. Appal. 314, 315; Grout, N. Am. Musc. Pl. 7, 345.

Scarcely to be distinguished from *B. salebrosum* except by the slightly scabrous seta, rather longer capsule and longer-acuminate leaves. There are all grades of roughness of seta and it is doubtful if this species is more than a variety of *B. salebrosum*. *B. oxycladon, B. glareosum, B. flexicaule, B. salebrosum, B. acutum, B. pseudocollinum* and *B. campestre* grade into each other and are difficult to separate satisfactorily.

5 BRACHYTHECIUM ALBICANS (Neck.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 553*. 1853.

Hypnum sericeum gracile albicans Dill. Hist. Musc. 328. *pl. 42, f. 63*. 1741.
Hypnum albicans Neck. Meth. Musc. no. 36. 1771; also Hedw. Descr. et Adumb. **4**: 13. *pl. 5*. 1793.
Hypnum flavescens Roth Fl. Germ. **3**: 303. 1800.
Brachythecium pseudo-albicans Kindb. Bull. Torr. Bot. Club **17**: 278. 1890.
B. salebrosum Waghornei R. & C. Bot. Gaz. **19**: 238. 1894.

Plants in rather loose glossy light-green mats; stems decumbent or ascending, much divided, irregularly branching, slightly radiculose; branches erect or ascending, terete-foliate, slender, 5–15 mm. long; branch leaves decurrent, appressed-imbricate when dry, ovate-lanceolate, smaller and narrower toward the end of the branches, 1.6–2.2 × 0.5 to 0.7 mm., slenderly long-acuminate, entire or rarely slightly denticulate, concave or bisulcate; margins more or less reflexed; costa extending beyond the middle; median cells linear-fusiform, 5–8 : 1; basal broader and shorter; quadrate alar cells numerous; stem leaves broader, 0.6–1 mm., wide, more abruptly narrowed to the slender acumination; perichaetium 2.5 mm. long; the leaves with loosely sheathing bases and spreading points; inner leaves exceedingly long-filiform acuminate from an oblong base, nearly entire, costa extending nearly through the body of the leaf. Dioicous. Seta 12–20 mm. long, sometimes 2 from 1 perichaetium, smooth, red-brown; capsule red-brown, ovoid, 2 mm. long, 2 : 1, unsymmetric, inclined or horizontal; little or not at all contracted under the mouth when dry; operculum convex-conic; annulus of 2 rows of cells, persistent; teeth of peristome linear-lanceolate, yellow brown; segments somewhat shorter than the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14–18 μ; rarely fruiting.

Type locality European.

On rocks and in dry sandy or grassy places. Rocky Mountains and westward in northern United States and Canada; Agattu Id., Behring Sea; Alaska; Greenland (Fl. Gr.); Cape Breton Island; Newfoundland and Labrador, Waghorne.

ILLUSTRATIONS.—Dill. l. c.; Br. & Sch. l. c.; *Pl. 7*.
EXSICCATI.—Macoun, Can. Musc. 285; Grout, N. Am. Musci Pl. 197, 470, 490.
Distinguished from *B. salebrosum, B. acutum* and other closely allied species by being dioicous and by its very slender pointed and entire leaves. *B. glareosum*, rare in America, is also dioicous but is much more robust and its slender pointed leaves are serrate. *B. pseudoalbicans* Kindb., from the type collection, is a form with leaves rather shorter acuminate, occasionally bearing a very few inconspicuous teeth and with a rather larger number of quadrate alar cells. The leaves, however, are not more denticulate than is sometimes the case with European specimens.

Var. OCCIDENTALE R. & C. Bot. Centralbl. **44**: 422. 1890.
More slender, more loosely foliate; leaves subsecund, shorter acuminate, denticulate. Montana (Röll.). Grout, N. Am. Musc. Pl. 164.

6 BRACHYTHECIUM PSEUDOCOLLINUM Kindb. Macoun, Cat. Can. Pl. **6**: 196. 1892.

Plants in loosely intricate, dark green mats; stems creeping, subpinnately branching, radiculose; branches about 5 mm. long, terete-foliate; branch leaves erect-spreading, 1–1.2 × 0.3–0.4 mm., very slightly decurrent, lanceolate, concave, serrate; margins reflexed at base; costa extending to middle; apex acute, slender, twisted; median cells linear, 8–10 : 1; basal shorter and broader, alar quadrate; stem leaves ovate-lanceolate, more loosely areolate, less strongly serrate, margins slightly reflexed, 1.4–1.6 × 0.6 mm.; perichaetium about 2 mm. long, sheathing; inner leaves ovate-lanceolate, costate, rather abruptly narrowed to a long-filiform acumination, nearly entire, very loosely areolate, leaf-cells 13 × 23 μ. Monoicous. Seta 15 mm. long, smooth, red-brown; capsule brown, ovoid-cylindric, 2 mm. long, 2–2.5 : 1, slightly unsymmetric, suberect; operculum long-conic; annulus lacking; segments as long as the teeth; cilia well developed, 1 or 2, strongly nodose or subappendiculate; spores 16 μ, strongly papillose.

Type locality under a well platform, Canaan Forks, N. B. (J. Moser); type seen. Also collected at Closter, N. J. (Austin); Connecticut, Young; Missouri, Bush; Alaska, Clark.

This is merely a reduced form or subspecies of *B. salebrosum;* practically the only important differences of importance are the smaller size and the shorter pointed leaves.

7 BRACHYTHECIUM SPLENDENS Aust. Bot. Gaz. 2: 111. 1877.

Brachythecium acuminatum subalbicans R. & C. Bot. Gaz. 15: 60. 1890.

Plants in dense glossy yellow-green mats, or sometimes dirty green; stems creeping, closely applied to the substratum, rhizome-like, 4–6 cm. long, sending up erect julaceous, densely foliate branches; branches terete-foliate, 5–20 mm. long; branchlets few; branch leaves erect, closely and regularly imbricate, broadly ovate-lanceolate to triangular-ovate, cordate-auriculate, slenderly long-acuminate, 1.5–2 × 0.6–0.8 mm., concave, 2 to 4 times plicate, distantly and finely denticulate; costa extending ⅔–¾ length of leaf; median leaf-cells linear, 12–15 : 1; basal and alar cells rhomboidal to quadrate; stem leaves broader, deltoid to triangular-ovate; apex long-subfiliform, resembling *B. albicans;* perichaetium 2.5 mm. long; the leaves sheathing at base with loosely erect tips; the inner ovate to ovate-lanceolate, abruptly narrowed to a long filiform acumination, distantly dentate-serrate above, thinly costate; the outer more strongly serrate and nearly ecostate. Dioicous (?). Seta 15 to 25 mm. long; smooth, dark chestnut; urn 2–2.5 mm. long, oblong-cylindric, erect and symmetric; teeth of peristome dark red-brown; segments narrowly linear, from a rather narrow basal membrane, yellow-brown; cilia single, slender.

Type locality, on palmetto trunks, St. Augustine, Fla., Feb., 1877 (J. Donnell Smith). On roots of cypress, Bellevue and Rosedale, Fla.; Louisiana.

No capsules except such as were old and deoperculate have been seen. The species is beautiful and distinct. It is distinguished from *B. biventrosum* by its much greater size and brilliant color and lustre. Austin's type is a small form of the species; this, perhaps, led him to confuse it with *B. biventrosum.*

8 BRACHYTHECIUM ROTEANUM DeNot. Cronaca, 2: 19. 1867; Epil. 117. 1869.

Brachythecium salebrosum var. *cylindricum* Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 550.* 1853.
Brachythecium salebrosum texanum Aust. Bull. Torr. Club, 6: 44. 1875.

Plants in glossy yellow-green mats; stems creeping, subpinnately branching; branches subjulaceous, 5–12 mm. long, terete-foliate; branch leaves more closely imbricated and appressed than in *B. salebrosum,* ovate-lanceolate, long-acuminate, 1.5–2 × 0.45–0.55 mm., serrate above, concave, often bisulcate with reflexed margins; costa extending ½ to ⅔ length of leaf; median cells linear-fusiform, 10–12 : 1; several rows of basal cells much enlarged, quadrate to oblong-hexagonal; lower stem leaves ovate, abruptly narrowed to a long slender acumination, nearly entire, 2–2.4 × 0.9 mm.; areolation much looser; upper stem leaves approaching branch leaves in size and shape; perichaetium 2.25 mm. long; leaves sheathing at base with spreading points; inner oblong-ovate, long-acuminate, nearly ecostate and entire. Monoicous. Seta 2.5 cm. long, red-brown, smooth; capsule red-brown, cylindric, nearly erect, slightly arcuate, about 3 mm. long, 4 : 1; operculum conic-rostrate; annulus (?), cilia 2 or 3, well developed, nodulose; spores granulose-roughened, 13 μ.

Type locality European.

Dallas, Texas (J. Boll); La., Drumm. Musc. Am. (S. States 123 "*Hypnum laetum* var?") Robinson's Spring, Florida, Grout.

Distinguished from *B. oxycladon* by being monoicous and by the conspicuously enlarged basal cells of the leaves; from *B. salebrosum* by the longer suberect capsule and leaves scarcely or not at all plicate; from both by its much shorter-acuminate perichaetial leaves. The American form here described is clearly distinct from either *B. salebrosum* or *B. oxycladon,* and is referred to *B. Roteanum* on the authority of C. Mueller, who identified a specimen of Boll's collection now in the Columbia Herbarium as *B. salebrosum cylindricum* Br. & Sch. I have not had authentic European material for comparison but the plant described answers very closely indeed to Limpricht's description of *B. Roteanum* (Rab. Krypt. Fl. 4³: 72). The specimen Austin described was from the same locality and collector as the specimen identified by Mueller.

Austin's type of var. *texanum* has the leaves little narrowed at the insertion, less concave and with margins little reflexed and the short broad basal cells are numerous and clear, this with its less shining appearance and more open leaves easily distinguishes it from *B. splendens.* I am strongly inclined to the belief that Austin's plant is not the same as the European *B. Roteanum* but I lack definite evidence.

9 BRACHYTHECIUM OXYCLADON (Brid.). Jaeger & Sauerb. St. Gall. Nat. Gesell. 1877–1878: 322.

Hypnum oxycladon Brid. Musc. Recent. Suppl. 2: 123. 1812.
Hypnum laetum Brid. Bryol. Univ. 2: 479. 1827.
Brachythecium laetum Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 554.* 1853.
Brachythecium spurio-acuminatum C. Muell. & Kindb. in Macoun, Cat. Can. Pl. Pt. 6: 191. 1892.

Plants in wide glossy yellow-green intricate mats; stems prostrate, irregularly divided, pinnately branching; branches unequal, 0.5–2.5 cm. long, attenuate at ends; upper branch leaves erect-open, ovate-lanceolate, slightly decurrent, 1.5–2 × 0.45–0.8 mm., acute to slenderly acuminate, apex often slightly twisted, serrulate nearly all around, concave, plicate, upper margins often slightly recurved; costa extending beyond the middle; median cells narrowly linear, 10 : 1; areolation gradually becoming shorter and broader toward the base; alar cells quadrate; stem leaves larger, 2–2.5 × 0.9–1.2 mm., often nearly entire, more deeply plicate; perichaetium 2–2.5 mm. long; leaves sheathing at base; the inner with spreading points, oblong-lanceolate, abruptly narrowed to a long filiform acumination, nearly entire or somewhat serrulate above, costa thin or wanting. Dioicous or rarely monoicous. Seta 1.5–2.5 cm. high, red-brown, smooth; capsule red-brown, oblong-cylindric, suberect, slightly arcuate, somewhat contracted below the mouth when dry, the neck gradually narrowed to the seta, 2.5–3.5 mm. long, about 4 : 1; operculum long-conic to conic-rostrate; annulus none; teeth of peristome light red-brown, rather abruptly narrowed to a slender hyaline point; segments from a broad basal membrane, nearly as long as the teeth; cilia two, strongly nodose or appendiculate; spores finely papillose-roughened, about 15 μ, maturing in autumn or early winter.

Type locality, Pennsylvania (Ludwig).

On earth, rocks, and roots of trees in woods. Northeastern United States and eastern Canada; west to Minnesota, Kansas and Nebraska; Colorado (Brandegee); south to North Carolina and Tennessee; Missouri (Bush). Apparently common.

Exsiccati.—As *H. laetum* Drumm. Musc. Am. (S. States), 122; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 329, (Ed. 2) 488, 489, 490; Austin, Musc. Appal. 309; Macoun, Can. Musc. 281, 566 (*B. spurio-acuminatum*); R. & C. Musc. Am. Sept. Exsic. 104, (*B. biventrosum*); Grout, N. Am. Musc. Pl. 198, 199.

Illustrations.—Br. & Sch. l. c.; Sull. Icon. Musc. *pl. 115;* M. H. M. 275.

Type specimens of both *B. oxycladon* and *B. laetum* have been examined. The branch leaves of the former are less serrate than those of the latter but the acumination and serration of the leaves varies so much, even on the same plant, that these characters alone cannot be used even to separate varieties. The species is exceedingly variable and it is difficult to separate varieties from its allies, especially *B. salebrosum;* the difficulty is increased by the fact that the species is very imperfectly dioicous.

Examination has been made of authentic specimens of *B. laetum* var. *fallax* R. & C. (Bot. Centralbl. **44:** 422. 1890), *B. laetum* var. *pseudo-acuminatum* R. & C., l. c.; *B. laetum Roelli* R. & C., l. c.; from type locality and from Herb. Cardot. The variety *fallax* seems to be nothing more than a local form with narrower leaves and a more dirty green color; var. *pseudoacuminatum* is a dwarfed and more caespitose plant, but differs in no essential particular from the ordinary form of *B. oxycladon* except, perhaps, in the more slender pointed branch leaves. Var. *Roellii* is not at all like *B. laetum,* having short julaceous branches and ovate to ovate-lanceolate leaves of about ½ the size of the leaves of *B. laetum.* All of these varieties were sterile and the species in the *salebrosum* group of *Brachythecium* are too closely related to make valid varieties from sterile specimens.

Renauld & Cardot's 104 differs in no essential respect from the ordinary *B. oxycladon* but as compared with the type of *B. biventrosum* it is larger and stouter; leaves broader and less slender pointed, basal areolation that of *B. oxycladon.* I am unable to agree with the opinion expressed by M. Cardot in Hedwigia **35:** 308, 310. 1896. M. Cardot tells me that he has not seen type specimens of *B. biventrosum* C. Muell. The specimens communicated by Lesquereux could not have been this species or he would not have confused it with *B. laetum. B. biventrosum* is very closely related to *B. acuminatum,* as is indicated by the erect capsule, imperfect peristome and general appearance.

B. oxycladon has typically branch leaves broader than in *salebrosum,* reaching 2 × 0.8 mm., less slenderly acuminate; stem leaves broader, more strongly plicate, with the quadrate alar cells smaller, thicker walled and often apparently more numerous: typically dioicous but not constantly so. It has the same habits and range as *B. salebrosum,* but it less frequently grows on decaying wood. In many cases the sporophyte of *B. salebrosum* is very much darker than in this species.

I have seen *salebrosum,* with the capsules as long and slender as those of *oxycladon* and *oxycladon* with capsules as short as those of *salebrosum* but this is not very frequent and the sporophyte characteristics are usually sufficient to separate these two species.

I am able usually to differentiate sterile and ambiguous specimens of *B. salebrosum* and *B. oxycladon* by the difference in the alar and basal cells which are fairly well illustrated in the figures. In *B. salebrosum* there are usually two or three rows of shorter, rather irregular cells along the whole base of the leaf and at the angles these large loose subquadrate cells are quite characteristic. In *oxycladon* these basal and alar cells are rather smaller and thicker walled.

B. oxycladon resembles *Hypnum Haldanianum* in appearance but has plicate leaves, is more glossy and has a shorter operculum. Under the microscope the presence of a costa at once differentiates it.

To sum up: if one has a *Brachythecium* that answers in a general way to the descriptions of *salebrosum* and *oxycladon,* is monoicous, has short curved capsules, leaves little plicate when soaked out on a slide (exclusive of the two large folds due to the concavity of the base), long and slenderly acuminate with basal cells rather loose like those figured in Plate LXII, M. H. M. then he has a clear case of *B. salebrosum.*

If the plant be dioicous, with long-cylindric, little curved capsules, stem leaves strongly plicate even

when mounted in water, basal and alar cells smaller and denser as figured in Plate LXIII, M. H. M., then he has a clear case of *B. oxycladon*. If one has a plant that will not exactly fit either of the above cases let him study it carefully and put it with the species it most resembles. There are a large number of intermediate forms in America that cannot be placed certainly, especially if sterile.

There seems to be good reason for believing that the American *salebrosum* approaches *oxycladon* much more closely than do the European forms of the species.

I have what is considered to be a portion of the plant from which Sullivant made his drawings of *B. laetum* and it is one of the forms running close to our *salebrosum*. European *salebrosum* seems to have the leaves less concave at base and more like *rutabulum*. The plant called *laetum* in Europe is much closer to our var. *dentatum* than the plant figured by Sullivant.

Forma FALCATUM Grout.

A very interesting xerophytic form unlike anything I have seen before. The plants are bright yellow with short stems and branches which are more or less curved at the ends; leaves strongly falcate-secund. Plants sterile.

Dry sandy shores of Douglas Lake, Michigan, June-August, 1920. G. E. Nichols, *No. 141*.

NOTES on *B. oxycladon*, its var. *dentatum* and *B. digastrum* by H. Dupret, Bryologist **30:** 58.

"The apical stem-leaves (innovations) are generally of a larger size than the middle stem-leaves in the same plant. Generally, also, the acumination of the middle leaves is longer than in the apical leaves. The examination of the size in the apical leaves is generally conclusive; for example, if at least two or three leaves present a wide base joined to a short acumen, it is a clear case of *B. digastrum*. Should the examination of the apical leaves not settle the doubt then take off all the branches and examine the lower leaves of the stem."

"Note carefully the differences in the acumination of the leaves of each species:

a. In *digastrum* the leaves may be barely acute; they are generally short-apiculate.

b. In *oxycladon* the leaves are clearly and sometimes very long-acuminate, with twisted acumen.

c. In *dentatum* all the leaves are barely acute, obtuse-acute or very short apiculate. Besides, they are very concave and noticeably plicate under the glass; also very asymmetric."

"The basal cells in *digastrum* and *dentatum* are large quadrate-rectangular, but not as clear as in *B. salebrosum*. In *oxycladon* they are theoretically smaller, sometimes roundish-globular. It should be borne in mind that the areolation, alone, is seldom conclusive, of itself; it must be considered only as a confirmation.

"The upper areolation is so finely-compressed in *oxycladon* as to be almost indistinct. It is a little shorter and laxer in *digastrum*, conspicuously shorter still in *dentatum*;* but all specimens are not typical in this respect, hence the statement above that the sole consideration of the areolation is not conclusive. More stress should be laid on the shape of the leaves, especially the apical and stem leaves. As for the branch leaves, they are, in many cases, so much alike in form in the three plants of the group that it is useless to waste much time with them."

"In short, in apical leaves, a very wide base, joined with a short acumination, points to *digastrum*. Not quite so wide a base, joined with a comparatively long acumination, is a sign of *oxycladon*, and, especially the long fine twisted acumen. A round-oval short base, joined to a barely acute apex, is the ordinary sign of *dentatum*. In this latter plant the apical and branch leaves have about the same shape, except that the branch leaves are narrower."

"As far as I know, *digastrum* is a rarer plant than either *dentatum* or *oxycladon*, which are quite abundant here, especially on rocks near the ground or along moist paths in the woods."

Var. DENTATUM (L. & J.) Grout. *l. c.*

Hypnum laetum dentatum L. & J. Mosses of North America 335. 1884.

Brachythecium Sullivantii Br. & Sch. Bryol. Eur. fasc. 52–54: Mon. 21. 1853.

Plants often submerged and dirty brownish green below; stems and branches slender, stem leaves broader and shorter, acute to acuminate, serrulate; branch leaves shorter pointed and more strongly serrate, more loosely areolate at base. Seta 3–3.5 cm. long, very slightly roughened at base; operculum short-rostrate; apparently growing in wet places on rocks and earth.

EXSICCATI.—Sull. Musc. Allegh. 43, in part only; Grout, N. Am. Musc. Pl. 122.

A very common form growing on moist rocks. The leaves are more strongly plicate, shorter and broader, shorter acuminate to acute; the leaf cells are also broader and shorter, the short basal and the quadrate alar cells much more numerous; seta occasionally somewhat roughened at base; operculum short-rostrate; apparently more common than the species in our region and passing into the next species by intergrading forms.

Forms of *B. oxycladon dentatum* from Green Knob, N. C., alt. 5,000 ft., show *B. digastrum* in the same tuft and sometimes one portion of a plant appears to be *B. oxycladon dentatum* and another portion, *B. digastrum*.

10 BRACHYTHECIUM DIGASTRUM C. Muell. & Kindb. Macoun, Cat. Can. Pl. **6:** 190. 1892.

Plants in wide, olive-green mats; stems radiculose, creeping and closely applied to the substratum, pinnately branching; branches 5–10 mm. long, subjulaceous, terete-foliate; branch leaves loosely appressed-imbricate when dry, erect-open when moist, ovate to oblong-ovate, acute to short-acuminate, with apex

* ?? A.J.G.

more or less twisted, 0.8–1 mm. long and about ½ as broad, decurrent, bisulcate, very concave; margins reflexed below, serrulate; costa stout, extending ⅔–¾ length of leaf; median cells fusiform-hexagonal, 5–7 : 1; basal much shorter; quadrate alar cells numerous; stem leaves triangular-ovate, longer acuminate, more loosely areolate at base, less conspicuously serrulate, 1.2 × 0.8 mm.; inner perichaetial leaves 2–2.5 mm. long, sheathing; leaves slightly or not at all reflexed at apex, oblong-ovate, thinly costate, very loosely areolate, rather abruptly contracted into a long-filiform flexous acumination, slightly denticulate or entire. Monoicous. Seta 15–20 mm. long, red-brown, smooth; capsule brown, oblong-arcuate, subhorizontal, 2–2.5 mm. long, 3 : 1; operculum long-conic, apiculate; segments shorter than the teeth; "cilia nodulose, not appendiculate, annulus none."

Type locality, McKay's Bush, Ottawa, Ont., Oct. 12, 1889, (Macoun). On rocks, Canada, Macoun and others, but probably to be found in the northeastern United States as well as in North Carolina.

ILLUSTRATION.—M. H. M. 277.

A careful study of *B. oxycladon* in its varying forms has led me to repudiate my former statement about it and *B. digastrum*. I regard *B. digastrum* as a derivative of *oxycladon* through the var. *dentatum* even though it is monoicous. It has been so little collected that the variations of the capsules are not well known and I expect forms to be found with capsules longer than those described above.

11 BRACHYTHECIUM WOOTONII Grout, Bryologist 29:.8. 1926.

Habit and appearance of *B. oxycladon*, but stems and branches shorter, as if depauperate or alpine. Stem leaves triangular-ovate, plicate with margins recurved below, long and slenderly acuminate, entire or slightly denticulate at apex; branch leaves ovate-lanceolate, scarcely plicate but concave at base with recurved margins, almost as slenderly acuminate as in *B. albicans*, but serrate in the upper half. Seta short; capsules small, suberect to horizontal; peristome normal, but the cilia uncertain by reason of the age of the capsules.

Except for the very long and slenderly acuminate leaves and small capsules, this plant would be referred to depauperate *B. oxycladon*. If it were more robust, with longer, more plicate and less serrate leaves and larger capsules, it would be hard to differentiate from *B. glareosum* B. & S. Indeed, I at first referred it to this species.

Type from Gilmore's Ranch, White Mts., Lincoln Co., New Mexico, Aug. 25, 1907. Alt. 7500 ft. E. O. Wooton and Paul C. Standley.

Type in herbarium of A. J. Grout.

12 BRACHYTHECEUM GLAREOSUM (Bruch.) Br. & Sch. Bry. Eur. Fasc. 52–54, Mon. 19. *pl. 552*. 1853.

Hypnum glareosum Bruch in sched., C. Muell. Syn. 2: 361. 1851.

A subspecies of *B. salebrosum* distinguished in typical forms by its larger size; leaves more plicate and long and slenderly acuminate as in *B. albicans*, but somewhat serrate above though usually less strongly so than in *salebrosum*. Dioicous. I have seen two collections that seem to belong to this species. One I collected from near Tolland, Colorado on soil in a coniferous forest, the other was collected by Mrs. F. A. MacFadden near New Denver, British Columbia. Both these plants are rather more slender than the typical European form. *B. albicans occidentale* approaches these slender forms closely but is not so loosely foliate. Anybody that can feel absolutely sure of identifying accurately all the myriad forms of the Western relatives of *B. salebrosum* has more confidence in himself than I have ever been able to attain. (*Pl. 7.*)

13 BRACHYTHECIUM TURGIDUM (Hartm.) C. Hartm. Kindb. Enum. 294. 1888.

Hypnum turgidum Hartm. Skand. Fl. Ed. 5: 328. 1849.
Hypnum plumosum turgidum Lindb. Musc. Scand. 36. 1879.

Plants in glossy, whitish-green to golden-green tufts; stems creeping, irregularly branching; branches very stout and turgid, julaceous, pointed, sometimes ending in flagella, 1–3 cm. long; leaves loosely appressed-imbricate, somewhat decurrent, lanceolate to broadly ovate-lanceolate, 2.5–3.5 × 0.9–1.2 mm., entire, gradually narrowed to a long-filiform acumination, strongly plicate, costate to middle; margins reflexed below; median leaf-cells 12–15 : 1; basal broader and shorter; alar rhomboid-quadrate; stem and branch leaves little different; perichaetial leaves sheathing, long-acuminate, entire, ecostate. Monoicous. Seta 1–2 cm. long, red-brown, smooth; capsule 3–3.5 mm. long, 3 : 1, subhorizontal, curved, somewhat con-

tracted under the mouth when dry; operculum conic; annulus of one row of cells; cilia one or two, nodose; spores 18–24 μ, nearly smooth, maturing in autumn.

Type locality European.

In alpine or boreal regions in grassy or stony places. Battle Harbor, Labrador; Stephen, Rocky Mts.; Lake St. John, Quebec; Greenland (Fl. Gr.). This species has much the appearance of *B. glareosum* but differs in its more turgid branches, entire leaves and in being monoicous. Not yet found fruiting in America. The description of the sporophyte is adapted from Limpricht.

BRACHYTHECIUM EDENTATUM Williams, Bryologist 6: 62. July, 1903.

"Low and loosely caespitose with lax, spreading leaves. Stems procumbent, with few, short and irregular branches. Stem leaves 1½ mm. long by ⅗ mm. wide, not decurrent, pale, ovate-lanceolate, shortly acuminate, concave, scarcely or not plicate, margin entire, flat; costa rather faint, extending a little above the middle, rarely shorter and forked, with sometimes small clusters of radicles on lower side at its base. Branch leaves smaller, entire. Leaf-cells above the base very narrow, the median .004 to .005 mm. wide and .04 to .05 mm. long. Alar cells abruptly enlarged, hyaline, often forming distinct, inflated, convex clusters. Perichaetial leaves but little longer than stem leaves, gradually acuminate, half costate, very entire. Dioicous. Pedicel smooth, up to 2½ cm. high. Capsule when moist about two and one-half times longer than broad, curved, much contracted under the mouth when dry. Annulus narrow. Height of conical lid scarcely equaling its basal diameter. Segments of inner peristome solid, with two or three smooth cilia between."

"This is one of the smaller species, in size perhaps nearest *reflexum*. It seems quite distinct from all others in the very entire leaves, with narrow cells above and inflated clusters in the angles. It differs from *B. Beringianum* Card. & Ther. in having the majority of leaf-cells little more than half as wide, in the different alar cells and in the low, creeping stems with lax, spreading leaves (374). Gold Run Cr., on wet earth, June 6." (Gold Run Creek, Alaska.)

BRACHYTHECIUM BERINGIANUM Card. & Ther. Proc. Wash. Acad. Sci. 4: 333. 1902.

"Densely caespitose, resembling in habit small forms of *B. albicans*. Stem erect, 3–4 cm. high, much branched, branches erect, sometimes fastigiate, julaceous, acute. Leaves crowded, imbricate, the stem leaves 1.5 mm. long, 0.8 broad, ovate-lanceolate, from a slightly decurrent base, quite abruptly and shortly acuminate, concave, plicate, with margins entire, plane or reflexed; the branch leaves smaller, longer acuminate; costa thin, 30–35 μ" thick scarcely reaching the middle; "alar cells numerous, quadrate, elongated in the five to six rows next to the margin, the rest linear, 40–45 μ long, 6–7 broad; walls incrassate. Other characters unknown." *Pl. 7.*

"From St. Paul Island (Trelease, 1861, 2087); Agattu Island (U. S. S. Albatross Exped., 40)."

"Distinct from *B. acuminatum* R. and C. by its habit, its more abruptly acuminate leaves, etc. It more closely resembles *B. albicans* Br. Eur., from which it differs by its shorter and more abruptly acuminate leaves, its quadrate, more numerous alar cells, its more chlorophyllose areolation, and by its narrower, short and often bifurcate costa."

BRACHYTHECIUM RUTABULUM (L.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 543 and 544.* 1853.

Hypnum rutabulum L. Sp. Pl. 1124. 1753.
Hypnum dentatum var. *vulgatissumum operculis obtusis.* Dill. Hist. Musc. 295. *pl. 38, f. 29.* 1741.
B. leucoglaucum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 198. 1892.
B. marabundum C. Muell. & Kindb. Cat. Can. Pl. 6: 194. 1892.

Plants robust, in wide, loose mats, glossy yellow-green; stems decumbent, arcuate, 5–10 cm. long, stoloniferous at the ends, irregularly divided, subpinnately branching; branches erect or ascending, 1–2 cm. long, gradually attenuate, terete-foliate to somewhat complanate-foliate; branch leaves loosely erect-spreading, ovate-lanceolate, very slightly decurrent, 1.5–2 × 0.5–7 mm., gradually long-acuminate, distantly serrate, slightly concave, scarcely plicate; costa extending ⅔ length of leaf, sometimes toothed on the back above; median cells linear, 15 : 1; basal cells little differentiated, somewhat shorter; stem leaves broadly ovate, more abruptly acuminate, 2–3 × 1–1.5 mm., less strongly serrate, more strongly decurrent; basal leaf cells conspicuously broader and shorter; a few of the cells at the extreme angles enlarged and inflated, denticulate above; inner perichaetial leaves about 3 mm. long, sheathing at base with squarrose

points; the inner oblong-ovate, rather abruptly narrowed to a very long filiform acumination, denticulate above, ecostate, the outer leaves often short-costate. Monoicous or rarely polygamous. Seta 2–3 cm. long, red-brown, very rough throughout; capsule red-brown, oblong, arcuate and horizontal, not contracted under the mouth when dry, 2.5–3.5 mm. long, about 1 mm. thick; operculum long-conic, apiculate to subrostellate; annulus of two rows of cells, persistent; teeth of peristome red-brown, margined, stout; segments nearly as long as the teeth; cilia 2 or 3, nodose, some often imperfectly developed; spores roughened, 13–16 μ, maturing in winter.

Type locality European.

On the ground and stones in wet places, less frequently on roots and stems of trees and decaying logs. Northern United States and Canada; south to New Jersey and Pennsylvania. Columbia Falls, Montana (Williams); Missouri, Bush.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. p. 279.

EXSICCATI.—Sull. Musc. Allegh. 45; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 331, (Ed. 2) 494 and 495; Austin, Musc. Appal. 318; R. & C. Musc. Am. Sept. Exsic. 243; Grout, N. Am. Musc. Pl. 66, 170, 171, 421 453, 500.

Quite variable in size and shape of leaves and in gross appearance. Macoun's Can. Musc. 591 on which *B. leucoglaucum* C. Muell. & Kindb. was founded has the seta very rough and cannot be distinguished from this species.

Var. FLAVESCENS (Brid.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 544.*

Hypnum flavescens Brid. Spec. Musc. **2:** 185. 1812.

Brachythecium platycladum C. Muell. & Kindb. Macoun, Cat. Can. Pl. **6:** 195. 1892. Can. Musc. 287, in part.

Plants straw-colored, very stout; stem and branches loosely foliate, turgid; stem leaves very broadly ovate, concave, abruptly short-acuminate. With the typical form. Montana; Jamaica Plains, Mass.

At first sight this form seems distinct from *B. rutabulum* but there is a complete gradation of forms from the typical plant to the variety. The stem leaves often resemble those of *B. rivulare* but they are longer acuminate and some of the branch leaves are not much different from those of typical *B. rutabulum. Pl. 8.*

This variety seems imperfectly dioicous, as both Kindberg and R. S. Williams describe it as dioicous. The Columbia specimen of Macoun's 287 (which is undoubtedly the same as that described by Kindberg) contained plants which bore both male and female branches.

Var. TURGESCENS Limpr. Laubmoose **3:** 109. July, 1926.

In swampy places not far removed from tide-water, there occurs a form which is golden-green with rather short and very thick turgid branches densely foliate with leaves somewhat striate and loosely imbricate, which I have referred to var. *turgescens.* The turgid terete leafy branches are 2 mm. or more in diameter.

17 BRACHYTHECIUM ASPERRIMUM Mitt. Journ. Linn. Soc. **8:** 33. 1865.

Hypnum vallium Sull. & Lesq. Musc. Bor. Am. Ed. 2, 506. 1865.

B. Villardi R. & C. Bot. Centralbl. **44:** 442. 1890.

B. gemmascens C. Muell. & Kindb., Macoun, Cat. Can. Pl. **6:** 195. 1892.

B. spurio-rutabulum C. Muell. & Kindb. l. c. 197.

B. columbico-rutabulum Kindb. l. c. 198.

B. subintricatum Kindb. Rev. Bryol. **22:** 86. 1895.

Plants in wide loose mats, yellow-green; stems 5–11 cm. long, decumbent or ascending and arcuate, stoloniferous at the ends, sparingly radiculose, pinnately branching; branches 5–15 mm. long, attenuate at the ends, terete-foliate; branch leaves rather distant, erect-open, occasionally somewhat falcate-secund, long-decurrent, ovate-lanceolate, gradually long and narrowly acuminate, strongly serrate above, somewhat concave and plicate, 1.6 × 0.45–0.6 mm., costate to beyond the middle; median cells linear, reaching 90 μ long, 10–15 : 1; basal and alar cells little differentiated, somewhat shorter and broader; stem leaves varying from broadly ovate and rather abruptly acuminate to elongated triangular-ovate and gradually long and slenderly acuminate, strongly plicate and decurrent, less strongly serrate, often nearly entire, basal cells more differentiated. Dioicous; male plants smaller and more slender; leaves more distant and narrower; antheridial branches large, subglobose; perichaetium 2.5 mm. long; the leaves with sheathing bases and squarrose recurved points; inner leaves oblong-ovate, rather abruptly long-filiform acuminate, costate. Seta 2–4.5 cm. long, red-brown, very strongly papillose; capsule red-brown, 2.5 mm. long, 2.5–3 : 1, oblong-ovoid, arcuate and horizontal, somewhat contracted under the mouth when dry and empty; operculum conic-apiculate; annulus present; cilia 2 or 3, strongly nodose; spores roughened, 13–20 μ, maturing in early winter.

Type locality, British Columbia (Lyall and Douglas).

On moist rocks, soil, and decaying wood. California, Idaho, Montana and intervening territory. British Columbia. Not yet reported east of the Rocky Mts.

ILLUSTRATIONS.—Sull. Icon. Musc. Suppl. *pl. 76;* Mitt. l. c.; *Pl. 10.*

EXSICCATI.—Sull. & Lesq. l. c.; Grout, N. Am. Musc. Pl. 154, 154a, 237 (as *B. albicans*).

Distinguished from *B. rutabulum*, which it resembles by being dioicous and having a much more slender habit. I have examined a portion of the type and find that it has long-filiform acuminate perichaetial leaves, although this is not in accordance with either Sullivant's or Mitten's figures. Specimens of *B. spurio-rutabulum* from Burrard's Inlet (Macoun, Can. Musc. 651) contain *B. asperrimum* mixed with another sterile moss which has very strongly plicate leaves. Authentic specimens of *B. columbico-rutabulum* from type collection can be separated from *B. asperrimum* by nothing excepting that they are said to be monoicous: no male branches could be found on any of the plants examined. Type specimens of *B. gemmascens* are certainly dioicous; they grew on a wet log and were apparently submerged at times, thus giving an unusual appearance to the plant: its principal leaf characters are identical with those of *B. asperrimum.* Cardot writes that he is sure *B. Villardi* is distinct from *B. asperrimum*, as he found male and female branches on the same plant. I, however, am not able satisfactorily to differentiate it and a specimen from Cardot himself seems dioicious, as a great abundance of male branches were found on one of the plants examined, but not a single female branch. Specimens of *B. subintricatum* from type collection are not distinguishable from *B. asperrimum.*

The branch leaves are more strongly serrate than figured by Sullivant.

18 BRACHYTHECIUM SUBASPERRIMUM Card. & Ther. Bot. Gaz. **37**: 377. *pl. 24, 1.* May, 1904.

B. pacificum Jennings Bryologist **16**: 95. Nov. 1913.

Subspecies of *B. asperrimum.* Differs in the softer flaccid tissue of the leaves which are also more plicate with leaf cells shorter, 6–7 μ wide by 45–70 μ long; the shorter basal and alar cells rather more numerous. Stem leaves often more broadly ovate than figured. *Pl. 10.*

Dr. Jennings has very courteously sent me a part of his type which I have carefully compared with that of Mitten. I find some of the branch leaves on Jennings' plants to be as strongly serrate as those of Mitten's.

Type from New Westminster, British Columbia, A. J. Hill, April, 1902. Jennings' type from Skidgate, Queen Charlotte Islands, W. Spreadborough, July 1, 1910. In Herb. Carnegie Museum.

EXSICCATI.—Baker, Pacific Coast Bryophytes 582 (apparently type duplicate); Grout, N. Am. Musc. Pl. 221 (Seattle, Bailey).

19 BRACHYTHECIUM LAMPROCHRYSEUM C. Muell. & Kindb. Macoun, Cat. Can. Pl. **6**: 199. 1892.

Plants in wide thick tufts, glossy golden-yellow to yellow-green, brown underneath; stems very stout, 5–10 cm. long, creeping and long persisting, ascending at the ends, irregularly divided, sending up numerous secondary stems; secondary stems 3–5 cm. high, irregularly branching, often slightly curved at the ends; branches few or numerous, 5–10 mm. long; cortical cells of stem large, often remaining as a row of inflated cells at base of leaf; branch leaves crowded to rather distant, slightly or not at all decurrent, open, ovate to ovate-lanceolate, 1.2 × 0.6 mm., acuminate with apex twisted, denticulate all around, strongly plicate; costa stout, extending ⅔–¾ length of leaf; median cells linear-oblong, 7–10 : 1; basal somewhat shorter and broader; alar not differentiated; stem leaves triangular-ovate, slightly auricled, 2–2.5 × 0.8–1.2 mm., more loosely areolate, very strongly plicate; basal and alar cells oblong to elliptical; costa extending ⅘ the length of the leaf, very slender above; perichaetium 2–3 mm. long; leaves sheathing at base, with squarrose-reflexed tips; inner leaves lanceolate, long-filiform acuminate, nearly ecostate. Dioicous. Seta 2–3 cm. long, brown, very rough; capsule brown, oblong-cylindric, 2–2.5 mm. long, 2.5–3 : 1, suberect to horizontal, unsymmetric to arcuate; operculum long-rostrate when dry; ⅓ to ½ length of urn; when moist, long and conic rather than rostrate; teeth long-filiform pointed; segments slender, as long as the teeth, widely open between the articulations; cilia 2, nearly as long as the segments, appendiculate; spores roughened, 16–20 μ. *Pl. 14, f. 12.*

On decaying wood in moist places, California; Colorado; Oregon; Washington; in calcareous springs, Idaho; apparently common in British Columbia and Alaska.

The long-rostrate operculum would seem to place this in Eurhynchium if this character only was considered, but all its other characters place it in close relationship with the *rutabalum* group of Brachythecium, nearly all of which have subrostellate opercula.

EXSICCATI.—Grout, N. Am. Musc. Pl. 254, 327, 338.

The plant from Comox, Vancouver Id., from which Kindberg evidently described the sporophyte, is *B. asperrimum*, hence some discrepancies in the description. The sterile specimens from Mt. Benson and

Mt. Finlayson should be regarded as the type. This species has much the aspect of *B. turgidum*, but has dentate, shorter pointed leaves and rough seta. It is distinguished from *B. rivulare* by its much longer-pointed strongly plicate leaves and less differentiated alar cells. It is nearest *B. Washingtonianum*, which is distinguished by its auriculate stem leaves. It is as a rule much larger than *B. asperrimum*, of which it seems to be a derivative.

Var. GIGANTEUM Grout, Mem. Torr. Bot. Club 6^2: 181. 1897.

Stems much stouter, secondary stems with fewer branches; stem leaves distant, longer, 3–3.5 mm. long, very strongly plicate; extreme alar cells inflated. Capsule ovoid; operculum conic-rostrate, annulus large, persistent; segments as long as teeth, from a very broad basal membrane; cilia 2 or 3, well developed, nodose; spores maturing in winter. The stem leaves are somewhat auricled and it is possible this variety might better be referred to *B. Washingtonianum*.

Type from Atku Island, Behring Sea. British Columbia, Mrs. MacFadden.

EXSICCATI.—Grout N. Am. Musc. Pl. 489.

Var. SOLFATARENSE Grout, N. Am. Musc. Pl. 327. Sept. 1, 1910.

A slender elongated lax form with very loosely areolate strongly decurrent leaves. Mixed with *B. rivulare*.

Type from Solfatara Creek, Yellowstone National Park, Mrs. M. B. Streeter.

20 BRACHYTHECIUM WASHINGTONIANUM (Eaton, Ms.), Grout Bryologist 3: 12. July 1900.

Plants in loose mats of bright glossy yellow-green; stems creeping, ascending, 5–10 cm. long, closely and more or less regularly pinnate, particularly near the ends; branches 7–12 mm. long; branch leaves equally spreading, strongly plicate, both moist and dry, ovate, not decurrent, 1.5–1.75 × 0.45–0.70 mm., broadest a little above the base and thence gradually narrowed to a long narrow apex, more strongly serrate above than in *B. lamprochryseum;* costa extending from one-half to two-thirds the entire length of the leaf; median cells linear-vermicular 0.080–0.125 mm. in length, 10–16 : 1; basal cells shorter and broader, extreme alar sometimes inflated and vesicular with a single row of much enlarged rectangular cells along the base (these frequently fail to be detached with the leaf); stem leaves of lower stems slenderly deltoid-ovate, auricled and decurrent (the auricles are often made more distinct by strong plicæ near the margin, as in *Climacium americanum*), 2–2.5 mm. long and about one-half as wide as the widest portion of the base; median and basal cells as in the branch leaves; auricular cells rectangular to hexagono-rhomboidal, the lower somewhat inflated and vesicular; perichaetial leaves sheathing, with long squarrose filiform apices, entire or distantly dentate above, ecostate or rarely with traces of a costa. Dioicous apparently; no male buds found. Seta 3–4 cm. long, red, becoming red-brown when old, very rough, very little or not at all twisted; capsule oblong-cylindric, arcuate and inclined, to nearly horizontal, with operculum about 3.5 mm. long, about 4 : 1, somewhat contracted under the mouth when dry; operculum conic and rostrate with a shining black, needle-like beak about one-third the height of the entire operculum; annulus inconspicuous, of a single row of cells; teeth red; segments slender, widely open along the keel, from a basal membrane about one-half their height, cilia two or three, well developed but shorter than the segments, nodose or slightly appendiculate; spores about 0.013 mm., shrunken and apparently immature on date of collection, November 23, 1890.

Type locality, moist banks, Mason county, Washington. C. G. V. Piper, No. 25, Nov. 23, 1890. *Pl. 10.*

Type in Eaton Herbarium at Yale. Co-type in Herbarium of Columbia University.

Washington, British Columbia, not rare. Idaho. Leiberg.

EXSICCATI.—Grout, N. Am. Musc. Pl. 162. 422.

Closely related to *B. asperrimum* and *B. lamprochryseum*, differing from both in its almost regularly pinnate branching and auriculate stem leaves; also from the former in the narrower, more strongly plicate stem leaves, branch leaves not decurrent, and in the longer, more slender, and more arcuate capsule. From the latter it also differs in the more slender habit and narrower, less plicate stem leaves. *B. asperrimum* and *B. Washingtonianum* are characterized by an operculum abruptly rostrate when dry, with a slender black shining beak, the operculum itself being some shade of brown. This is well illustrated in Sullivant's figures of *B. asperrimum*, Icones Musc. Suppl., *pl. 76.* When moist, this operculum becomes long-conic and rostrate, as shown in the plate. Taken by itself, this species might be referred to *Eurhynchium* or *Camptothecium*, but it is certainly more closely related to *B. asperrimum* and *B. lamprochryseum* than to any other species. The capsules of *B. asperrimum* in Sullivant's figures are more slender than is the rule in a large series of specimens examined. *Pl. 10.*

21 BRACHYTHECIUM RIVULARE Br. & Sch. Bry. Eur. fasc. 52–54. *pl. 546.* 1853.

Hypnum vagans Drumm. Musc. Am. 166 (Specimen in the Can. Nat. Museum studied)

Plants variable but usually very robust, in wide thick mats, dark green to yellow-green; stems woody, creeping, filiform, leafless when old, distantly foliate with small leaves when young; secondary stems typically somewhat dendroid, stout, ascending-arcuate, 3–6 cm. long, nearly free from branches below, irregularly branching above; branch leaves ovate to ovate-lanceolate, somewhat decurrent, reaching 1.5 × 0.6 mm.,

acute to short-acuminate, dentate above with small sharp pointed teeth, strongly concave and often somewhat plicate; margins plane or slightly reflexed below; median cells 10–15 : 1; basal broader and shorter; extreme alar cells abruptly enlarged; leaves of secondary stems very characteristic, distant, broadly ovate, rather abruptly short acuminate, reaching 2 × 1.4 mm., concave, more or less plicate, denticulate; costa often forking; median cells 8–10 : 1; alar cells abruptly enlarged and inflated. Dioicous. Seta 1.5–2 cm. long, red-brown, very rough; capsule 2–3 by 1 mm., oblong-ovoid, unsymmetric to arcuate, inclined or horizontal; peristome perfect; spores maturing in early autumn.

Common on stones in bed of brooks and in other places that are always moist and are occasionally submerged but not always under water. The broad, short-pointed leaves of the secondary stems and their enlarged and inflated alar cells are characteristics which readily distinguish this species in all its protean forms.

On moist ground near the edges of water it becomes glossy yellow-green, approaching *B. salebrosum* in appearance; growing in quiet streams it often becomes long, slender, and almost floating, the secondary stems reaching a length of 10 cm. or more. Another form will have the secondary stems simple and long flagelliform. Like *B. oxycladon* this species is imperfectly dioicous. There is some evidence that plants bear antheridia one year and archegonia the next.

Type locality European.

Northern U. S. & Canada across the continent, south to Virginia and Missouri; not yet reported from the west coast of the U. S.

Illustrations.—Bry. Eur. l. c.; M. H. M. 281.

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 377, (Ed. 2) 505; Aust. Musc. Appal. 319, 320, 321 and 317 (as *B. rutabulum*); R. & C. Musc. Am. Sept. Exsic. 244; Grout N. Am. Musc. Pl. 9, 114, 241, 298, 403, 441 var.; Musci Perfecti 28.

Var. cataractarum Sauter, Fl. Hertzog. Salzburg **3**: 60. 1870.

Floating, dark green to golden green, brown underneath; secondary stems much elongated, simple or sparingly branched; branches short, directed forward at an acute angle; leaves much more closely imbricated, especially at the tips of the branches.

On timbers of an old dam, Staley's creek, Virginia; sterile (Dr. J. K. Small).

Var. laxum Grout, Bryologist **4**: 48. July 1901 (*Fig. 1*).

Plants very lax, sparingly branched; leaves more loosely areolate than in typical forms; all but the lowest slenderly acuminate as in *B. rutabulum* but having the alar cells of this species. In habit this resembles robust forms of *Calliergon cordifolium*. Sterile and doubtfully assigned to this species. Avalanche Trail, Flathead Co., N. W. Montana, J. M. Holzinger and J. B. Blake.

Exsiccati.—Grout, N. Am. Musc. Pl. 78.

Var. lamoillense Grout, Bryologist **7**: 44. May 1904.

B. rivulare tenue Grout, Bryologist **7**: 34. March 1904.

Varying toward *B. Nelsoni;* prostrate or ascending, irregularly branched, slender, very light glossy yellow; lower leaves distant, often spreading, the upper closely imbricated giving the plants the appearance of *B. oxycladon;* stem leaves acuminate with a rather short slender point. Type from Lamoille Cave, Minnesota. Holzinger.

Exsiccati.—Grout N. Am. Musc. Pl. 200.

In the swampy lands near the coast and possibly in other localities there occur numerous forms intermediate between *B. rivulare* and *B. rutabulum*. Some of these are very puzzling and have suggested hybrids to me. One of these forms was named *B. noveboracense* by me and described in the Bryologist **3**: 36 (12), 1900, but the peculiar capsules of the specimens described I believe to have been freakish and unusual. It is probably nearer *rutabulum*. The alar cells are larger and the leaf apices shorter as a rule. The leaf apices are longer and alar cells smaller than is usual in *B. rivulare*. The leaf characters are somewhat intermediate between these two species and those of *B. Starkei*, but the stem leaves are longer and ovate rather than deltoid ovate. The stem leaves are more distant than in any of the related species, reminding one of *Hypnum cordifolium*.

Brachythecium Nelsoni Grout, Bryol. **5**: 76. Sept. 1902.

Plants with the facies of undersized *B. rivulare*, but not dendroid; stems 5–8 cm. long, irregularly to subpinnately branching; stem leaves erect-spreading, triangular-ovate, slenderly long-acuminate, about 1.5–2 × 0.6 mm., slightly concave with margins turned inwards towards the apex, slightly serrulate at extreme apex; branch leaves similar to the stem leaves but smaller and usually proportionately narrower, the upper often serrate above, decurrent, with a large area of abruptly enlarged and inflated alar cells which are separated from the ordinary cells by a narrow band of much smaller oblong cells. These alar cells are much like those of *B. rivulare*, except that they occupy a larger area; median and apical cells much as in *B. rivulare*, costa stout at base, rapidly narrowing in the lower portion, extending about two-thirds the length of the leaf; perichaetial leaves slightly costate. Apparently dioicous. Sporophyte not differing essentially from that of *B. rivulare*. *Pl. 10.*

La Plata Mines, Wyoming, Aug. 25, 1898. Coll. Elias Nelson, no. 5172. Com. J. M. Holzinger. Apparently growing on humus. Type in herb. A. J. G.

This plant is very close to *B. rivulare* but differs distinctly in its triangular long-acuminate leaves, which are different from any I have examined. The inflated alar cells are also much more numerous, extending well toward the costa.

I found it very common in the Rocky Mountains in the vicinity of Tolland, Colorado.

23 BRACHYTHECIUM PLUMOSUM (Sw.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 537.* 1853.

Hypnum plumosum Sw. Disp. Musc. Suec. 66. 1799. Not Huds. or Hedw.
Hypnum pseudo-plumosum Brid. Musc. Rec. 2^2: 108. 1801.
Hypnum flagellare Hedw. Sp. Mus. 282. *pl. 73, f. 1–3.* 1801, (*fide* Limpricht). Not Dicks.
Hypnum chrysostomum Mx. Fl. Bor. Am. **2**: 319. 1803, (*fide* Limpricht).
Brachythecium rutabuliforme Kindb. Macoun, Cat. Can. Pl. **6**: 198.
Eurhynchium semiasperum, Kindb. Macoun, Cat. Can. Pl. **6**: 207. 1892.

Plants robust, in wide loosely-intricate mats, brownish-green to golden-green, usually glossy on the surface, brown underneath; stems 3–6 cm. long, creeping, subpinnately branching, clinging closely to the substratum at the borders of the mats; branches ascending or erect, straight or somewhat curved, 5–10 mm. long; branch leaves equally spreading or somewhat secund, rather loosely erect-spreading, lanceolate to broadly ovate-lanceolate, long-acuminate, 1.1–1.5 × 0.4–0.5 mm., serrate to serrulate above, sometimes nearly entire; costa extending ⅔ the length of the leaf; median cells linear, 8–12 : 1; a few basal cells broader and shorter; quadrate alar cells few, thick-walled and opaque; stems leaves often somewhat decurrent, narrowly triangular-ovate to broadly ovate, acuminate, more loosely areolate, nearly entire to serrate above; perichaetium 1.5–2 mm. long; leaves sheathing, with spreading points, oblong-ovate to oblong-lanceolate, rather abruptly narrowed to a long slender acumination, nearly entire, more or less distinctly costate. Monoicous; male branches abundant. Seta 7–20 mm. long, dark red-brown to almost black, rough above, nearly smooth below; capsule chestnut-brown, black when old, oblong-ovoid, 2.2–2.5 mm. long; 2.5 : 1, horizontal to suberect, nearly symmetric or slightly curved, slightly contracted under the mouth when dry; operculum conic, almost rostrate; annulus narrow, of a single row of cells; segments short, about equaling the high basal membrane; cilia 2 or 3, well developed, appendiculate; spores nearly smooth, 13–16 μ, maturing in late autumn.

Type locality European.

Subaquatic, on moist rocks in woods and in brooks, especially in mountain regions. Northeastern United States and Canada; west to Minnesota; British Columbia; south to Fla., Underwood.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 283.

EXSICCATI.—Sull. Musc. Allegh. 40; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332, (Ed. 2) 496 and 498; Austin, Musc. Appal. 325, 326, 327; Macoun, Can. Musc. 289; R. & C., Musc. Am. Sept. Exsic. 110; Grout, N. Am. Musc. Pl. 10, 449, Musci Perfecti 88.

Distinguished from most of the species by having the seta smooth below and rough above; from *B. campestre* by having the leaves shorter, more abruptly pointed, nearly entire and not plicate; from *B. populeum* by the shorter costa, which does not extend into the apex; all the accessible descriptions speak of the perichaetial leaves as ecostate, but the perichaetial leaves of Limpricht's Bryol. Sil. 242 and Husnot's Musc. Gall. 277a were very conspicuously costate and such was the case in all the American specimens examined. Specimens of *B. rutabuliforme* from the type collection have the seta nearly smooth below instead of very rough and are certainly referable to *B. plumosum.*

Var. HOMOMALLUM Br. & Sch. l. c. Branches curved at apex, leaves falcate-secund, smaller. With the ordinary form.

EXSICCATI.—Sull. Musc. Allegh. 41 *Hypnum pseudoplumosum;* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332b, (Ed. 2) 497.

Var. PRINGLEI (Williams) Grout, Bryologist **5**: 41. May 1902.
B. Pringlei Williams, Bull. Torr. Bot. Club **29**: 67. *pl. 4.* Feb. 1902.

An extremely large form with leaves reaching 2.5 × 1.5 mm., secund, long-decurrent, broadly ovate, short acuminate, entire or slightly serrulate. Immature capsules somewhat unsymmetric and suberect.

Type from Huachuca Mts., Arizona, July 1884. C. G. Pringle.

The nature of the basal and alar cells and the seta papillose in the upper part only, clearly indicate the relationship of this form.

Homomallous leaves are very common in this species. Dixon states it is difficult to find English plants from which they are completely absent.

Var. ROELLII (R. & C.) n. comb.
B. Roelii R. & C. Bot. Centralbl. **44**: 422. 1890.

Leaves more strongly serrate, more strongly decurrent. "Dioicous."
Type locality. Vancouver.
Type material from Cardot seen.

BRACHYTHECIUM POPULEUM (Hedw.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 535* and *536*. 1853.

Hypnum populeum Hedw. Sp. Musc. 270. *pl. 70, f. 1–6*. 1801.
Hypnum Stereodon Laureri Funck; Brid. Bryol. Univ. 2: 595. 1827 (*fide* Limpricht).
Hypnum saxicola Voit; Sturm, Deutschl. Fl. 2: fasc. 12. 1812.
Brachythecium nanopes C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 201. 1892.

Plants in wide, loosely intricate mats, dark green to yellowish green; stems 2–5 cm. long, creeping, stoloniferous, attached to the substratum by dense fascicles of radicles, subpinnately branching; branches 3–10 mm. long, terete-foliate; branch leaves erect-spreading; the upper lanceolate, the lower broadly ovate-lanceolate, 1–1.2 × 0.25–0.4 mm., slightly decurrent, subulate-acuminate, more or less concave, nearly entire or finely serrate above; margins revolute below; costa stout, extending into the apex, nearly or quite percurrent; median leaf-cells linear-oblong, 5–8 : 1; several rows of basal and alar cells rhomboidal to quadrate; stem leaves 1.4–1.8 × 0.5–0.6 mm., broadly ovate, slenderly acuminate with apex usually more or less contorted, nearly entire, not plicate or sulcate; leaf-cells broader and shorter; perichaetium 1.5–2 mm. long; the leaves sheathing at the base, with spreading points, oblong-lanceolate, rather abruptly narrowed to a subfiliform acumination, entire or slightly serrate above; costa well developed. Autoicous. Seta 10–12 mm. long, red-brown, roughened above with low broad papillae, nearly smooth below, (sometimes nearly smooth throughout); capsule brown, short-ovoid, unsymmetric, horizontal, 2 : 1; operculum very long-conic; annulus persistent, of a single row of cells; segments as long as the teeth, split between the articulations; cilia stout, variable, 1–3, more or less appendiculate; spores finely roughened, about 15 μ, maturing in early winter.

Type locality European.

On stones, roots and trunks of trees, rarely on soil, northeastern United States and Canada; Revelstoke, B. C.; North Carolina; Minnesota.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 285.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 333, (Ed. 2) 499. Austin, Musc. Appal. 328; Macoun, Can. Musc. 441, 548 (*B. nanopes*); Grout, N. Am. Musc. Pl. 38.

Quite variable in size and shape of leaves and robustness of growth. Distinguished by its long-conic operculum, percurrent costa and partially roughened seta.

Var. MAJUS Br. & Sch. l. c. *pl. 536.β*.
Stouter, glossy, nearly bronze-colored, densely foliate, leaves longer; habit of *B. plumosum*.

Var. RUFESCENS Br. & Sch. l. c.
Mats depressed, closely adhering to the substratum; branches short, numerous, erect or ascending; steam leaves appressed, shorter and narrower, broadly lanceolate; bronze-colored, seta shorter.
On rocks, New Haven, Ct. (Pease).

Var. OVATUM Grout Mem. Torr. Bot. Club 6^2: 190. 1897.
Often having the appearance of var. *rufescens*, but with the stem leaves broadly cordate-ovate, 1.4 by 0.8 mm., concave, margins reflexed below, rather abruptly narrowed to a much shorter subulate acumination; costa very stout, often ending below apex; branch leaves ovate-lanceolate, median cells 5 : 1.
On dry rocks in woods with *Grimmia apocarpa*. Johnson and Peacham, Vt.; Indian Falls, Owen Sound; New Harbor, Newfoundland. Probably a habitat form, as it grows on dry rocks instead of moist.
EXSICCATI.—Grout, N. Am. Musc. Pl. 4.
ILLUSTRATION.—M. H. M. l. c.

BRACHYTHECIUM REFLEXUM (Starke) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 539*. 1853.

Hypnum reflexum Starke, Web. & Mohr. Bot. Taschenb. 306 and 476. 1807.
Leskea laxifolia Hook. Musc. Exot. *pl. 30*. 1818.
Hypnum laxifolium Schwaegr. Musc. Frond. Suppl. 2^1: 159. *pl. 143*. 1824. Lesq. & James, Man. 342. 1884.
Hypnum subtenue James, Proc. Acad. Phila., 1855: 447. 1855.

Plants in wide, loosely intricate, dark green mats (occasionally yellow-green in sunny places); stems filiform, 5–10 cm. long, arcuate-procumbent, radiculose at points of contact with substratum, pinnately branching; branches filiform, about 5 mm. long, ascending, terete-foliate, attenuate at apex, not radiculose; branch leaves erect-open, loosely appressed-imbricate when dry, lanceolate, decurrent, 0.6–0.9 × 0.25–0.4

mm., gradually acuminate, serrate above, slightly concave; costa stout, extending into apex; median cells oblong-rhomboidal to oblong-hexagonal, 3–5 : 1; quadrate alar cells very numerous, extending up the sides of the leaf; stem leaves 0.8–1.2 × 0.5–0.8 mm., deltoid-ovate, long-acuminate; acumination equaling ⅓ to ½ entire length of leaf. Perichaetium 2 mm. long; leaves sheathing at base, with spreading tips; inner leaves oblong-ovate, long-acuminate, entire or serrate at apex, nearly ecostate. Monoicous. Seta 10–15 mm. long, red-brown, very rough, twisted to the right below and usually to the left above; capsule red-brown to nearly black when old, 2 mm. long, 2 : 1, ovoid, horizontal, not constricted under the mouth when dry; operculum conic, apiculate; annulus of two rows of cells; cilia 2 or 3, stout, appendiculate; spores nearly smooth, 15–18 μ, maturing in autumn or early winter.

Type locality European.

On decaying logs, roots of trees and detritus of siliceous rocks. Mountains of northern United States and eastern Canada; west to Lake Huron and Montana; Maryland.

Illustrations.—Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 94;* Rab. Krypt. Fl. 4³: f. 373; M. H. M. 282.

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 503; Austin, Musc. Appal. 540; Macoun, Can. Musc. 286; Grout, N. Am. Musc. Pl. 202.

Limpricht l. c. states that the spores are papillose but I have been unable to find rough spores in either European or American material. Easily distinguished from the other American species by its filiform stems and branches and the areolation of the leaves approaching that of Amblystegium.

Hooker's type of *Leskea laxifolia* from the Northwest Coast (Menzies) has been seen and Dr. Best, Mrs. Britton and myself are agreed that it is this species.

26 Brachythecium glaciale Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 542.* 1853.

"Much resembling *B. Starkei;* differing in its short, *obtuse, julaceous branches*, with the leaves *closely imbricated, not spreading nor distant, narrower, widely ovate-lanceolate, not cordate*, decurrent, plicate; branch-leaves narrower and more longly acuminate; areolation as in that species. Perichaetial bracts imbricated, erect. Seta short, rough. Capsule shortly oblong, turgid. Cilia of inner peristome *nodulose, rarely appendiculate.* Autoicous."

Type locality European.

Illustrations.—Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 94;* Rab. Krypt. Fl. 4³: *f. 372; Pl. 8.*

Macoun, Can. Musc. 735a, from earth and rocks, Cape Breton Id., Nova Scotia is the only American specimen of this species that I have seen.

"The well-marked forms of *B. glaciale*, as I gathered it about the snow-line in Norway and the Pyrenees, are very distinct in the terete, julaceous branches with erect, striate leaves, from the ordinary forms of *B. Starkei*, in which the leaves are much looser, not appressed nor julaceous, and the habit is more straggling. The apparently clear distinction vanishes, however, when one comes to examine a series of plants, and is compelled to recognize the existence of intermediate forms. When in fruit the perichaetial bracts, erect in *B. glaciale*, spreading at the points in *B. Starkei*, appear to give a good distinguishing character."

No two European authorities seem to agree in their descriptions of this species and as a consequence the material in herbaria is much mixed. Consequently I have quoted the description and part of the notes of Mr. H. M. Dixon, in whose judgment I have great confidence. However, the authors of the species described the leaves as "erecto-*patentia.*" For further distinctions see under *B. pacificum.*

27 Brachythecium Bestii nomen nov.

Brachythecium pacificum (R. & C.) Grout, Pub. Puget Sd. Biol. Sta. 3[58]: 54. 1921.
B. reflexum pacificum R. & C. Bot. Centralb., No. 51. 1890.
Eurhynchium pacificum Kindb. Eur. & N. Am. Br. 101. 1896.

More slender than *B. glaciale*, more robust than *B. reflexum*, with more closely appressed stem leaves ovate-lanceolate, scarcely triangular; leaf cells rather more than twice as long, median reaching 80-90 μ; "angular cells rectangular seldom quadrate"; costa generally vanishing in the base of the acumination, sometimes percurrent. *Pl. 12.*

Pacific coast, Oregon to Alaska. Cardot gives several stations from Alaska. Cape Breton Id., *No. 1432*, 1915, and also *No. 99* of 1909, G. E. Nichols. Traille River Divide, Idaho, alt. 7,000 ft., "On shady crevices of quartzite ledges, J. B. Leiberg, *No. 260*" White Bay, Newfoundland, 10-6-91. Sent by Dr. Best, probably collected by Waghorne.

Up to the year 1919 I had confused this moss with *B. glaciale* Br. & Sch. Others here and abroad had confused it with *B. reflexum* (Starke) Br. & Sch. and *B. Starkei* (Brid.) Br. & Sch.

This group, including *B. reflexum, B. glaciale, B. Starkei*, and *B. pacificum*, has puzzled bryologists for a long time, not only in America but also in Europe. Part of my bewilderment is attributable to a specimen

from Greenland, ex-herb. Schimper, communicated by Cardot, as *B. glaciale*, which is not that species, but a very robust form of *reflexum* approaching, *Bestii* or, possibly, it may be near the var. *micropus* (*B. micropus* B. & S.).

Although I have not studied the calyptra and peristome of these forms from North America, forms of *B. reflexum* approaching *micropus* in gametophyte characters are not rare in North America. They run larger in size and have the leaves less abruptly acuminate, with leaf-cells longer and narrower.

B. Starkei is the most robust of the group, with leaves spreading, scarcely plicate, of tenalmost complanate, very widely cordate-ovate. *B. glaciale* is more slender, julaceus, with leaves appressed, somewhat plicate, with the costa perhaps averaging a little longer than in *B. Starkei*, but this is not constant.

B. pacificum is much more slender than *B. glaciale*, approaching *B. reflexum* in habit, but with leaves less closely appressed when dry, costa longer and stronger than in *Starkei* or *glaciale*, but not consistently percurrent. Leaf-cells much like those of *Starkei* in outline, but smaller.

B. reflexum is typically very slender, almost filiform, with widely cordate-ovate leaves, abruptly long-acuminate, leaf-cells much as in the shorter-celled *Amblystegia*, typically about 5 : 1 in the steam-leaves.

According to Braithwaite, Bottini considers *B. reflexum micropus* a hybrid with *B. populeum*. There is much to suggest hybrids in the varying and intergrading species of this group. *B. Starkei* and *B. reflexum* are common in the mountain regions of North America, apparently less frequent westward. I have *B. Bestii* from Norway, communicated by Holzinger.

ILLUSTRATION.—Proc. Wash. Acad. Sci. **4**: *pl. 23, f. 4a–c; Pl. 12.*

Named in honor of Dr. G. N. Best.

Jennings (see *B. subasperrimum*) used the name *pacificum* for a species of Brachythecium before I published Cardot's variety as a species. Thus *Brachythecium pacificum* became a synonym and will have to be discarded, as least in so far as this species is concerned.

BRACHYTHECIUM STARKEI (Brid.) Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 541.* 1853.

Hypnum Starkei Brid. Musc. Rec. 2^2: 107. 1801.

Eurhynchium pseudoserrulatum Kindb. Ottawa Nat. **7**: 22. 1893.

Plants in wide, loose mats, dark green, seldom whitish-green; stems irregularly divided, pinnately branching, decumbent or ascending, often stoloniferous, arcuate and rooting at the tips; branches 5–20 mm. long, ascending and arcuate at the ends, more or less complanate-foliate; middle branch leaves distant, spreading, ovate-lanceolate, 1.4–1.7 × 0.7–0.9 mm., narrowly acute to acuminate, with apex often twisted, somewhat decurrent, strongly serrate, not plicate or sulcate when moist; costa extending beyond the middle; median cells linear-fusiform, 13 : 1; basal shorter and broader; a few of the alar cells rhomboidal to quadrate; stem leaves broadly ovate, broadly long-acuminate, less strongly serrate, more loosely areolate with a much larger area of rhomboid-quadrate cells at the base and alar angles; perichaetium 2.5 mm. long; leaves loosely sheathing, with squarrose points; inner leaves oblong-lanceolate, gradually long and narrowly acuminate, costate, nearly entire; outer leaves shorter, ecostate. Monoicous. Seta 2–2.5 cm. long, red-brown, roughened with large distinct papillae; capsule oblong-ovoid, dark red-brown, 2–2.5 mm. long, ½ as thick, strongly arcuate, horizontal, slightly narrowed under the mouth when dry; operculum conic; annulus of about two rows of cells; segments a little shorter than the teeth; cilia 2 or 3, appendiculate; spores nearly smooth, about 14 μ, maturing in winter.

Type localities European.

On decaying logs and stumps in moist mountain regions. Northern United States and Canada across the continent; Vancouver Island; Montana; south to New Jersey and Pennsylvania.

ILLUSTRATION.—Br. & Sch. l. c.; *Pl. 8.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 336, (Ed. 2) 504; Austin, Musc. Appal. 323; Grout, N. Am. Musc. Pl. 62.

Fragmentary specimens of *Hypnum oedipodium* Mitt. (Journ. Linn. Soc. **8**: 32. 1865) of the type collection and from both the localities cited in the original description have been examined and could not be differentiated from the ordinary American *B. Starkei*. Specimens of *B. curtum* Lindb. identified by Lindberg himself, have been accessible through the kindness of V. F. Brotherus. The costa of the upper branch leaves was often found ending in a spine, and the cilia were also appendiculate. I have thus far been unable to differentiate *B. curtum* from *B. Starkei* in either American or European material. All the characters given as distinctive are quite variable, even on the same plant in many cases. The majority of the specimens of *B. Starkei* from northeastern North America are more loosely intricate and straggling than the typical European plant, they are also markedly complanate-foliate and the costa often ends in a spine and is toothed on the back above. These forms are probably referable to var. *complanatum* Limpr. l. c.

BRACHYTHECIUM VELUTINUM (L.) Br. & Sch. Bryol. Eur. fasc. 52–53. *pl. 538.* 1853.

Hypnum velutinum L. Sp. Pl. 358. 1753.

Hypnum intricatum Schreb. Sp. Flor. Lips. 1771.

Hypnum declivum Mitt. Journ. Linn. Soc. 8: 33. *pl. 6.* 1865.
Brachythecium pseudo-erythrorrhizon Kindb. Hedwigia, 35: 68. 1896.

Plants in wide, dark green to light yellowish-green mats; primary stems about 5 cm. long, creeping, radiculose with fascicled radicles, irregularly divided, very sparingly leafy, leaves often reduced or even wanting in places, branching irregularly pinnate; branches short, 2–5 mm. in length; branch leaves loosely spreading, somewhat falcate-secund at the ends of the branches, lanceolate to ovate-lanceolate, 1–1.3× 0.25–0.30 mm., gradually long-acuminate; apex usually falcate or twisted; margin serrate; costa extending beyond the middle, often toothed above on the back; median cells linear, 12 : 1; quadrate alar cells very few, confined to the extreme angles; stem leaves more narrowly lanceolate, usually longer acuminate, often much reduced in size; perichaetium 2 mm. long; leaves few, sheathing at base, the inner oblong-ovate, rather abruptly narrowed to a long acumination, sharply dentate above; costa wanting or short and slender. Monoicous. Seta 15 mm. long, light brown, sometimes reddish, very rough, slightly or not at all twisted; capsule brown, short-oblong, arcuate, horizontal, contracted under the mouth when dry, 2–2.5 mm. long, 2–3 : 1; operculum conic; annulus large, easily detachable; segments lanceolate, as long as the teeth, attached to a basal membrane of medium width, more or less split along the keel; cilia 2 or 3, nodose or subappendiculate; spores yellow-brown, minutely roughened, 10–13 μ, maturing in autumn, winter, and early spring in New England.

Type locality European.

On earth or stones and trunks of trees at the base, in shady places. Northern United States and Canada, south to New Jersey; Calif. (Howe).

ILLUSTRATIONS.—Dill. Hist. Musc. *pl. 42, f. 61;* Br. & Sch. l. c.; M. H. M. 286.

EXSICCATI.—Sull. & Lesq. Mus. Bor. Am. (Ed. 2) 500; Austin, Musc. Appal. 324; Macoun, Can. Musc. 379; Grout, N. Am. Musc. Pl. 60, 409.

Varying a great deal in robustness, roughness and length of seta and color of capsule, capsule often yellow-green. "A very variable species, plants slender or robust; stems more or less divided, and the branchlets varying in length; leaves close or more distant, bright green or yellow, opaque or glossy; capsule subglobose or oblong, on a short or long pedicel." Lesq. & James, Mosses of N. A., p. 340. *B. pseudo-erythrorrhizon* Kindb. is inserted as a synonym on the authority of M. Cardot (*vide* Hedwigia 35: 308, 1896), as no specimens have been accessible.

BRACHYTHECIUM PETROPHILUM Williams, Bull. N. Y. Bot. Garden 2: 136. 1901.

"In low, dense tufts or sometimes in thin mats with long creeping stems and short subpinnate branches. Stem leaves 1.5 mm. long by .4 mm. wide, narrowly ovate-lanceolate, about one-half costate, serrulate all round, more or less decurrent and margin reflexed near base, not very concave and scarcely or not plicate. Median leaf-cells linear-flexuous, up to .065 mm. long and .005 mm. wide. Alar cells short and broad, not forming a distinct cluster. Branch leaves very similar to stem leaves but mostly a little smaller, with longer costa ending in spine on back and adjacent cells sometimes papillose by the projecting upper ends. Inner perichaetial leaves pale, ecostate, gradually narrowed to a slender, flexuous, serrulate point, with rarely 1 or 2 coarse teeth at base. Capsule nodding, curved, with lid about 2.5 mm. long and 1 mm. broad. Lid conical, its height about equal to basal diameter. Annulus of two rows of cells. Teeth of peristome hyaline-bordered, papillose above, outer plates striate, inner lamellae about 30, segments without rounded perforations, more or less split along the keel with mostly 2 appendiculate cilia between. Seta rough throughout, up to 1.2 cm. high. Smooth spores up to .011 mm." *Pl. 7.*

"Dawson, on rock. In good fruit June 24, 1898. (722.)"

William's original description is given. He states it is nearest *B. suberythrorrhizon* but "differs in rough pedicel, leaves narrower, less serrate and plicate and cilia appendiculate" I still think as previously stated (Bryologist 5: 41) that it is nearer *B. Thedenii*, from which it differs in its more crowded shorter acuminate not falcate leaves with fewer quadrate alar cells and the rough seta. But in the *velutinum-collinum* group the roughness of the seta is variable. The spinose costa and papillose leaf cells are very little in evidence and rarely observed.

Bartram finds a form of what seems to be the same thing in Arizona. The leaves are narrowly lanceolate and seta less roughened, but as rough as one seta I found in Williams type collection. This I have called forma LANCEOLATA. A form very close to this was collected by Bailey at Menastash Canyon, Ellenberg, Washington and was issued as no. 476 of my N. Am. Musci Pleurocarpi.

BRACHYTHECIUM LEIBERGII Grout, Mem. Torr. Bot. Club 6^2: 197. 1897.

Plants in wide densely intricate green mats; stems decumbent or ascending, 3–5 cm. long, pinnately branching; branches 5–10 mm. long; branch leaves falcate-secund, decurrent, 1.2 × 0.4 mm., lanceolate,

bisulcate or often plicate, gradually very slenderly acuminate, serrate, costate to beyond the middle; median cells fusiform, 8–10 : 1; basal shorter and broader; quadrate alar cells numerous; stem leaves ovate to ovate-lanceolate, more strongly plicate; perichaetium 2.5 mm. long, loosely sheathing; leaves oblong-ovate, abruptly filiform-acuminate, nearly ecostate. Monoicous. Seta 1.5–2 cm. long, red-brown, roughened with rather low blunt papillae, little twisted; capsule light brown, 1.5 mm. long, 1.5–2 : 1, short-ovoid, unsymmetric, horizontal; operculum short conic; annulus present; segments as long as teeth, cilia two or three, well-developed, appendiculate; spores smooth, 10–12 μ, maturing in winter or early spring.

Type locality, summit of "Bareknob" Traille River Basin, Idaho, alt. 5500 ft. (J. B. Leiberg, 288. July, 1891).

Washington, frequent; Montana; Idaho; Colorado, frequent.

The gametophyte closely resembles *B. erythrorrhizon*, from which it differs in the rough seta and in being monoicous. Easily distinguished from *B. velutinum* by the larger stem leaves.

Exsiccati.—Allen, Mosses of Cascade Mts. 105a, 105b.

22 Brachythecium collinum (Schleich.) Br. & Sch. Bryol. Eur. fasc. 52–54, *pl. 548*. 1853.

Hypnum collinum Schleich. Cat. 1815.
Leskea Fendleri Sull. Mem. Am. Acad. **4**: 169. *pl. 1*. 1849.
Hypnum Fendleri Sull. Icon. Musc. 189. *pl. 117*. 1864.
Brachythecium Hillebrandi Lesq. Mem. Calif. Acad. **1**[1]: 33. 1868.

Plants small, slender, in thin intricate mats, bright green and glossy above, often dirty green below; stems creeping, radiculose, much branched; branches erect, slender, usually julaceous, often subdivided, 3–6 mm. long, terete-foliate; branch leaves closely imbricate, ovate to broadly ovate-lanceolate, 0.3–0.5 × 0.7–0.9 mm., rather abruptly acuminate, serrulate at base, sharply serrate above, concave; costa extending to middle; median cells linear-oblong to fusiform, 3–6 : 1; quadrate alar cells numerous, usually chlorophyllose, extending up the margin; stem leaves broadly ovate; perichaetium 1.8–2 cm. long; inner leaves oblong-ovate, abruptly narrowed to a slender acumination, serrate; costa thin and short or wanting. Monoicous. Seta 5–12 mm. long, yellow-brown, smooth or slightly roughened; capsules brown, ovoid, unsymmetric to arcuate, contracted below the mouth when dry, 2 mm. long, 2 : 1; operculum conic; annulus broad, of two rows of cells, easily detached; the segments as long as the teeth, lanceolate, attached to a basal membrane of medium width; cilia well developed, one or two, with sometimes rudiments of a third, nodose; spores yellow-brown, very nearly smooth, 10–12 μ, maturing in autumn.

Type locality European.

On earth and rocks in mountains of western United States and Canada; Peace River, Mt. Shasta, Colorado, Montana, New Mexico, and intermediate points; Greenland (Fl. Gr.).

Illustrations.—Br. & Sch. l. c.; Sull. l. c.; *Pl. 9*.

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 501, (*Hypnum Fendleri*); Macoun, Canadian Musci, 398; Röll 1540, 1540a, 1565a. Ren. & Card. Musc. Am. Sept. Exsic. 107; Grout, N. Am. Musc. Pl. 448, 498.

After a critical examination of two sets of Fendler's collection from the type locality of *Leskea Fendleri*, no valid distinction between this and *B. collinum* could be detected as the seta of *B. collinum* is usually slightly roughened in both European and American specimens. Also one capsule of Fendler's plant had two well developed cilia. No specimens of *Brachythecium Hillebrandi* of the original collection have been accessible and all the specimens examined which have been referred to this are undoubtedly *B. collinum*. There are no distinctions except the shorter capsule, rough seta and simple annulus. The length of capsule is always subject to considerable variation.

B. collinum frequently has a rough seta and the terms simple and compound, as applied to the annulus, have been used in a very loose way. As described and illustrated in recent literature the leaves of *B. collinum* are more abruptly acuminate, with a larger area of quadrate alar cells than that shown in the illustration from the Bry. Eur. *pl. 548*.

Var. idahense (R. & C.) n. comb.

B. idahense R. & C. Bot. Gaz. **15**: 60. *pl. 9, C*. 1890.

More robust; leaves more or less falcate, less abruptly acuminate; median leaf cells longer, 6–8 : 1; quadrate alar cells rather more numerous. With the exception of the alar cells the Bry. Eur. plate illustrates this variety rather better than the typical form according to Limpricht. Widely distributed with the species.

Type specimens from Cardot himself seen and studied. This variety of *collinum* grades into *B. erythrorrhizon* through its var. *suberythrorrhizon* so that it is extremly difficult to delimit the species and varieties.

BRACHYTHECIUM UTAHENSE James, Bot. King Exped. 409. 1871.

Plants light green, loosely caespitose, small and slender; stems short, creeping, radiculose, irregularly branching; branches 3–5 mm. long; branch leaves pluriseriate, loosely imbricate, oblong-lanceolate to ovate-lanceolate, 0.9 × 0.3–0.4 mm., acuminate, serrulate below, serrate above, somewhat concave; margins slightly reflexed below; costa extending to the middle or beyond; median cells linear-fusiform, 6–9 : 1; quadrate alar cells numerous; perichaetium 0.8 mm. long; inner leaves serrate, acuminate from a broad sheathing base, ecostate. Synoicous; antheridia mixed with the archegonia. Seta about 5 mm. long, brown, smooth; capsules brown, subglobose to oblong-ovoid, erect, nearly or quite symmetric, 2 mm. long, 3 : 1; operculum long-conic; annulus obscure; segments linear-lanceolate, as long as the teeth; basal membrane comparatively narrow; cilia rudimentary 1 or 2; spores yellow-brown, very slightly roughened, 10–15 μ, maturing in winter.

Type locality, sandstone rocks overhanging a dry stream bed near Hanging Rock Station, Echo Canyon, Utah, alt. 6000 feet (Watson); also found at Bald Mt., western Montana (Watson); Arizona (Pringle).

ILLUSTRATIONS.—Sull. Icon. Musc. Suppl. *pl. 73. Pl. 9.*

Closely allied to *B. collinum* but easily distinguished by the erect capsule and rudimentary cilia.

BRACHYTHECIUM ERYTHRORRHIZON Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 547.* 1853.

Plants in wide, intricate mats, light green, somewhat glossy; stems slender, 4 cm. or more long, radiculose, pinnately branching, not stoloniferous; branches 3–8 mm. long, ascending, the longer often arcuate and decumbent; branch leaves erect-spreading, 1–1.5 × 0.3–0.5 mm., more or less falcate-secund, lanceolate to ovate-lanceolate, gradually long and narrowly acuminate, serrate above, often plicate, costate to above the middle; margins more or less reflexed; median cells linear-vermicular, 8–10 : 1; quadrate alar cells distinct; stem leaves larger, ovate- to ovate-lanceolate, plicate, nearly entire; perichaetial leaves loosely erect, ovate to oblong-lanceolate, narrowly long-acuminate. Dioicous. Seta 10–15 mm. long; red-brown, smooth; capsule red-brown, ovoid, unsymmetric and horizontal, 2 mm. long, 2–2.5 : 1; operculum conic, apiculate; annulus present; segments somewhat shorter than the teeth; cilia 1 or 2, well developed; spores 14–20 μ, roughened, maturing in autumn.

Type locality European.

Washington, Clealum Lake Ridge; Belt Mountains and Columbia Falls, Montana; Colorado; White Mountains; Newfoundland; New Brunswick; Whiteface Mt., N. Y.

ILLUSTRATIONS.—Br. & Sch. l. c. *Pl. 9.*

Careful comparison of this species with specimens of *B. harpidioides* C. Muell. & Kindb. Macoun, Cat. Can. Pl. **6:** 194, make it almost certain that the two are identical. Although Prof. Macoun assures me that the specimens sent are identical with Kindberg's types, the plant from New Brunswick is not the same as that from British Columbia which appears to be *B. erythrorrhizon.*

Var. SUBERYTHRORRHIZON (R. & C.) n. comb.

B. suberythrorrhizon R. & C. Bot. Gaz. **19:** 238. *pl. 22, B.* 1894.

Differs from the type in being monoicous and in its narrower shorter acuminate leaves. Type from Springdale, Boulder Co., Colorado.

Type seen and studied. *Pl. 12.*

BRACHYTHECIUM THEDENII Br. & Sch. Bryol. Eur. fasc. 52–54. *pl. 17.* 1853.

Stems 5–10 cm. long, slender and creeping, often stoloniferous; *branching regularly pinnate;* branch leaves lanceolate, long filiform-acuminate; perichaetial leaves very long filiform-acuminate. Seta distantly but distinctly papillose.

Errol Dam, Androscoggin River, N. H. (James); Ottawa, Macoun; Burnt Side Lake, Minn., Wood.

This is one of the rarest of mosses, found in Europe in Finland and Sweden only.

James' plant has been carefully compared with authentic European specimens and it differs chiefly in the larger leaves, which approach *B. erythrorrhizon.* The slightly scabrous seta is a character not heretofore noted, but it is quite conspicuous in specimens from Sweden which were identified by Schimper himself.

Schimper's figure exaggerates the serration of the perichaetial leaves.

BRACHYTHECIUM BOLANDERI (Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1877-78: 324.

Hypnum Bolanderi Lesq. Trans. Am. Phil. Soc. **13:** 12. 1869.

Plants in wide, pale green mats; stems 3–5 cm. long, irregularly divided, creeping, subpinnately branching, sparsely radiculose; branches 3–6 mm. long, ascending, terete-foliate; branch leaves erect-spreading,

rather distant, ovate-lanceolate, gradually acuminate, 0.6–0.8 × 0.25–0.3 mm., serrate all around, not concave or plicate, costa extending beyond the middle; median leaf-cells rhomboidal-fusiform, 36 × 6 μ: basal cells shorter and broader; quadrate alar cells few, a few shorter cells running up the margin; lower stem leaves smaller, less distinctly serrate, often nearly entire, upper reaching 1.2 mm., otherwise little different; perichaetium 2 mm. long, loosely sheathing; inner leaves oblong-lanceolate, long-filiform acuminate, serrate with a few distant teeth, costa slender or lacking. Dioicous. Seta 1–1.5 cm. long, red, very rough; capsule brown, 1.5–2 mm. long, 2 : 1, ovoid, unsymmetric, horizontal; operculum conic-apiculate; annulus large, compound; teeth of peristome red-brown below; segments a little shorter than the teeth, from a broad basal membrane; cilia 2, as long as the segments, nodose; spores nearly smooth, about 10 μ, maturing in April.

Type locality, on shaded ground, Calif. (Bolander); also collected at Olema, Marin Co. (Howe).

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 502.

LITTLE KNOWN OR DOUBTFUL SPECIES

Brachythecium pseudo-Starkei Ren. & Card. Bot. Centralbl. **44**: 423. 1890.

"Dioicous, loosely caespitose, green; stem erect or ascending, flexuous, laxly pinnate, branches elongate, attenuate: leaves not close, patulous, ovate-lanceolate, plicate, acuminate, acumen long, sometimes tortuous; margin generally serrate all around; costa extending into the acumen; cells linear-rhomboidal, elongate, attenuate, alar lax, soft, quadrate, hyaline: not fruiting."

Washington, (Röll.).

Evidently aquatic, very lax and distantly foliate, with the habit of an Amblystegium. Related to *B. rivulare* and *B. rutabulum;* distinguished from both by its slender habit; from the first by its more slender-pointed leaves; from the second by having the leaves plicate and the branch leaves shorter-pointed. Stem leaves 1.8–2 by 1 mm.; middle branch leaves 1.4 by 0.8 mm.

Brachythecium cavernosum Kindb. Rev. Bryol. **22**: 86. 1895.

"Differs from *B. rutabulum:* leaves very concave, plicate, recurved on both sides to the acumen; lower basal and alar cells small, green and not well defined; lid of the capsule longer apiculate or rostellate."

"Amer. Canada: White, com. Macoun."

Brachythecium calcareum Kindb. l. c.

"Resembles *B. intricatum* (*Hypnum* Hedw., *Brachythecium velutinum* (var.) Schimper) in the habit; differs from *B. laetum* (Brid.) Kindb. (non Schimp.), not occurring in Europe, in the entire stem-leaves, the larger alar cells and the shorter costa, from *B. salebrosum* also in the leaves curved or secund in dry state."

"Leaves crowded, long-acuminate and filiform-pointed, denticulate at the acumen or (the stem-leaves) nearly entire, more or less recurved, incurved falcate when dry, patent when moist; cells linear, the angular short, the alar ones few, much larger and hyaline. Stem-leaves with a broad base; costa short, mostly vanishing near the middle. Branch leaves narrow; costa nearly reaching to the acumen. Capsule small, arcuate; cilia not appendiculate; lid apiculate; pedicel smooth, about 1 centim. long. Tufts dense and radiculose, green and faintly glossy. Stem irregularly divided; branches not compressed; monoicous."

"Limestone rocks, Canada, Ottawa; 1892, Macoun." Macoun's 838a from the same locality, June 8, 1899, agrees with Kindberg's description except for the fact that the seta is slightly roughened as in *B. campestre.* It seems clear that this is merely a form of *campestre* with leaves unusually falcate-secund.

Brachythecium Fitzgeraldi (C. Muell.) R. & C. Rev. Bryol. **20**: 17. 1893.

Hypnum (*Brachythecium, Cavernularia*) *Fitzgeraldi* C. Muell. Flora, **70**: 224. 1887.

"Dioicous; tufts low, pulvinate, broad, yellow, loosely interwoven; stem with branches short, more or less parallel, slender, round-julaceous; branchlets very short, rather spreading, single: stem leaves closely appressed, when moist scarcely spreading with cordate base semi-circularly impressed, rather broad ovate, short-acuminate; more or less ventricose-concave on both sides of the narrow vanishing deeply canaliculate green costa; margin nearly plane, everywhere slightly denticulate; cells very narrow, long, pale yellow; alar cells many, small, hexagonal; fruit unknown."

Type locality Florida. Collected by Fitzgerald. Specimens not seen.

Brachythecium Holzingeri Grout, Bryol. **25**: 14. 1922.

The type from Sperry Glacier seems not to be a Brachythecium but an Amblystegium. Brinkman's specimen referred to in the above citation has been lost or mislaid.

BRACHYTHECIUM LABRADORICUM (Kindb.) Paris.

Eurhynchium labradoricum Kindb. Eur. & N. Am. Bry. Pt. 1: 101. 1896.

"Differs from *E. glaciale:* leaves larger somewhat glossy, not appressed when dry; cells sublinear except the large not numerous alar; costa vanishing near middle. Stem-leaves gen. entire; branch-leaves long-acuminate minutely denticulate above. Perichetial leaves patent. Capsule curved; pedicel quite smooth, 3–4 c. m. long; lid acute; peristome not seen.—Amer. r. Can. Northern Labrador: Macoun 1896."

Brotherus recognizes this species in both editions of Engler & Prantl but groups it with the salebrosa near *B. flexicaule.* The original description, quoted above, is not definite enough to enable one to get any adequate conception of the species and no authentic specimens have been available.

BRACHYTHECIUM PSEUDOVELUTINOIDES (Kindb.) Broth. E. & P., Musci, Ed. 2. 2: 363.

Eurhynchium pseudo-velutinoides Kindb. Rev. Bryol. 22: 84. 1895.

"Leaves not or slightly striate, distant, subulate-acuminate and filiform-pointed, faintly reflexed near the base. Stem leaves subobovate or ovate-oblong, entire; costa scarcely reaching to the middle. Branch leaves ovate-lanceolate, denticulate all around; costa reaching somewhat above the middle. Perichaetial leaves with a very long filiform point. Capsules not found: pedicel rough. Tufts loose and green. Stems pinnate, not creeping. Leaves patent or spreading when dry. Probably monoecious."

"Canada, Vancouver Island, earth (1893): Macoun."

No specimens available and original description quoted.

SCLEROPODIUM Br. & Sch. Bry. Eur. 1853.

Closely allied to Brachythecium and included in it by some authors; differing slightly in the general habit and in the julaceous branches with concave, often obtuse leaves; leaf cells very long and narrow, 10–20 : 1. Stem leaves abruptly and slenderly acuminate in most species. Seta rough; capsule as in Brachythecium. All of our species are western. *S. illecebrum* and *S. caespitosum* are also European.

1. Leaves broadly ovate to suborbicular, without pointed apex or at most short-cuspidate; auricles distinct, consisting of plainly dilated cells; aquatic ..... *obtusifolium.*
   Leaves ovate to lanceolate; stem leaves slenderly acuminate, without distinct auricles; terrestrial ..... 2.
2. Differentiated basal and alar cells few ..... 3.
   Differentiated basal and alar cells in several rows ..... 4.
3. Branch leaves ovate-lanceolate to lanceolate, acute to acuminate; capsules suberect and nearly symmetric ..... *colpophyllum.*
   Branch leaves ovate to oblong-ovate, obtuse to abruptly short-acuminate; capsules horizontal and unsymmetric ..... *illecebrum.*
4. Seta rough throughout; median leaf cells 7–12 : 1 ..... 5.
   Seta smooth below; median leaf cells 14–18 : 1 ..... *californicum.*
5. Branches slightly julaceous; capsules suberect and nearly symmetric ..... *caespitosum.*
   Branches strongly julaceous; capsules more arcuate and unsymmetric ..... *apocladum.*

This genus is perhaps too near Brachythecium. The relationship with Eurhynchium is much more distant. The relationship between *S. colpophyllum* and *S. caespitosum* is so close that about half the specimens of the former in American herbaria have been referred to the latter.

SCLEROPODIUM ILLECEBRUM (L. *p.p.*) Br. Sch. Bry. Eur. *pl. 557.* 1853.

Hypnum illecebrum L. *p.p.* Sp. Pl. 1129. 1753.
Hypnum Touretii Brid. Sp. Musc. 2: 185. 1812.
Hypnum illecebrum Schwaegr. Suppl. 1, part 2: 225. 1816.
Hypnum blandum Lyell in Hook. & Tayl. Musc. Brit., Ed. 2: 176. 1827. Suppl. *pl. 5.* 1827.

Plants in wide spreading mats, varying from dirty green to bright glossy green: stems 3–10 cm. long, creeping, irregularly divided, irregularly or often subpinnately branching, partially denuded of leaves in the older portions, sparingly radiculose, younger portions ascending and much like the branches; branches

short, rarely reaching 1 cm. in length, julaceous, turgid, ascending to erect, more or less arcuate, usually obtuse: branch-leaves appressed-imbricate when dry, erect-open when moist, varying greatly in shape; those from the middle of the larger branches broadly ovate to oblong-ovate, 1.2 × 0.6 mm., abruptly narrowed to a short point, finely and sharply serrate above, sometimes nearly entire, very concave, slightly sulcate when dry, smooth when moist, not decurrent but half clasping, acumination of leaves often squarrose-spreading when dry; costa extending ¾ the length of the leaf, sometimes ending in a dorsal spine; median cells linear-vermicular, 0.005 mm. wide and 12–18 : 1, apical much shorter; basal subquadrate, colored and thicker-walled; alar somewhat larger and less deeply colored; leaves of the shorter branches and upper and lower leaves of the longer branches often lack the acumination and are obtuse or obtusely acute; stem leaves averaging larger, in robust plants reaching 2.3 × 1 mm., gradually tapering to a longer acumination, nearly or quite entire, those of the younger stems scarcely to be distinguished from the branch leaves; perichaetial leaves oblong-lanceolate, gradually narrowed above to a slender entire or subdenticulate acumination, faintly costate, acumination less slender than in *S. caespitosum*. Dioicous. Seta 1–2 cm. long; greenish brown, becoming red brown with age, twisted to the right, very rough with large papillae; capsule a little lighter colored than the seta, horizontal, unsymmetric or arcuate, with operculum 2.5 mm. long, 2.5–3 : 1; operculum long-conic, acute; annulus of two rows of cells, easily deciduous; teeth united at base, nearly colorless and papillose above; segments nearly as long as the teeth, finely papillose, from basal membrane equaling two fifths the length of the teeth; cilia 2, well developed, appendiculate; spores nearly smooth, maturing in winter.

Forma *pinnatifidum* from California in the Gray Herbarium at Harvard is more slender and nearly regularly pinnate.

Type locality, France, near Paris. Type at Paris.

On shady grassy soil and on shaded rocks.

California, Idaho, Washington, British Columbia, Vancouver.

Exsiccati.—Sulliv. & Lesq. Musc. Bor.-Am., Ed. 2, 508; Grout, N. Am. Musc. Pl. 410, 411; Allen, Mosses Cascade Mts. 102.

Illustrations.—Bry. Eur. *pl. 557;* Husnot, Musc. Gall. *pl. 95;* Dixon & Jam. Handb. Brit. Mosses, *pl. 53, G;* Limpricht, Rab. Krypt. Fl. **4:** *f. 378; Pl. 11.*

The robust habit, julaceous turgid branches, and thick unsymmetric horizontal capsules make this species easy to recognize when typical. It grades insensibly into *S. obtusifolium* and it is often very hard to say to which species certain forms should be referred.

Scleropodium obtusifolium (Hook.) Kindb. Cat. Can. Pl. **6:** 202. 1892.

Hypnum obtusifolium Hook. Drumm. Musc. Am. no. 193.
Hypnum arcticum var. Muell. Syn. **2:** 432. 1851.
Stereodon obtusifolius Mitt. Journ. Linn. Soc. **8:** 42. 1865.

Plants submerged or nearly so, attached to stones in brooks, light green above, brown below; stems irregularly branching, naked below and roughened by the leaf bases of the fallen leaves; young stems and branches julaceous; branches 5–20 mm. long; leaves closely imbricate and appressed when dry, more open when moist, broadly ovate to suborbicular, very concave, spoon-shaped, round-obtuse, without acumination or very shortly cuspidate, 1.2 × 1 mm., not plicate or sulcate except under pressure, entire or faintly denticulate near apex; costa stout, extending five sixths the length of the leaf; median leaf cells linear-vermicular, 0.05–0.065 mm. long, 8–10 : 1; apical cells broader and shorter, 2–3 : 1; alar cells rather abruptly enlarged to form distinct auricles, 0.013 mm. long, 3 : 1. Seta 1–1.5 cm. long, very dark and rough; capsule ovoid, nearly or quite symmetric, cernuous, with operculum 3–3.5 mm. long, 2–2.5 : 1; operculum conic-rostellate; peristome perfect, teeth dark red below, lighter and papillose above; cilia and segments about the length of the teeth; cilia appendiculate, sometimes unequal; annulus apparently lacking. Spores in winter, infrequent.

Sporophyte described from Allen's 103.

Type from rivulets in the Rocky Mts., Drummond. Type not seen, probably at Kew.

Described from Drummond's Musc. Am. 193, which is sterile. *Pl. 14, f 8.*

California, Nevada, Idaho, Montana, Washington, Oregon, British Columbia.

Exsiccati.—Grout, N. Am. Musc. Pl. 109, 109a; Allen, Mosses Cascade Mts. 103; Macoun's Canadian Musci 359 is very much larger and in every way more robust than the type, but has all of the distinctive microscopic characters. The same is true of Renauld and Cardot's Musc. Sept. Exs. 111. Sullivant and Lesquereux, Musc. Bor.-Am., edition 2, no. 509 (*Hypnum illecebrum* var.), is fairly representative of the species and bears the mature sporophyte, which differs little from that of *S. illecebrum*. The capsule is a

little shorter and there are sometimes as many as four strongly nodose cilia in the endostome: the seta is exceedingly rough with very high papillae: operculum short rostrate when dry.

There can be no doubt that this should be regarded as a subspecies of *S. illecebrum.* The plants nearest the type are always submerged and nearly always sterile. A complete series can be traced from the typical form described above to typical *S. illecebrum.*

Dr. M. A. Howe has collected specimens on moist, shady banks at Berkeley, California, June 28, 1894, that have the leaf characters of the typical form, except that the leaves are longer in proportion to their width. This goes to show that the submerged growth is not entirely the cause of the inflated alar cells, shorter leaf cells and more concave leaves.

In some cases the plants are flaccid with more distant, less closely appressed leaves constituting forma *laxum.*

A form from Goldstream, Vancouver Island, Macoun, May 18, 1887, has erect branches 3–4 cm. long, strongly curved at the ends, bearing suborbicular, strongly secund leaves 2 mm. in length. For this I suggested the name var. *homomallum.* This variety is the extreme development of the robust form while the typical form is at the other extreme.

SCLEROPODIUM APOCLADUM (Mitt.) Grout, Bull. Torr. Bot. Club **26:** 535. Oct., 1899.

Hypnum apocladum Mitt. Journ. Linn. Soc. **8:** 35. 1865.

Plants in wide interwoven mats of medium thickness, light green above, dirty green below the surface, somewhat resembling *Eurhynchium strigosum praecox* in appearance; stems creeping, 1–4 cm. long, irregularly branching; branches often fascicled, simple or sparingly divided, 3–8 mm. in length, julaceous, attenuate; branch leaves appressed-imbricate when dry, those on the branches below the surface of the mat erect-spreading, ovate, acute to short-acuminate, scarcely decurrent, slightly serrulate at apex, otherwise nearly entire in the type, other specimens finely serrulate nearly to the base, somewhat concave, not plicate or sulcate; costa extending at least four fifths the length of the leaf, stout; median cells linear-oblong, 7–9 : 1; quadrate basal and alar cells very numerous; apical cells broader and shorter; the leaves near the apex of the branches narrower and more longly acuminate; leaves of creeping stems variable in shape, semiorbicular and abruptly short-acuminate to ovate and longer acuminate; perichaetium 4.5 mm. long, the inner leaves long-lanceolate, long and slenderly acuminate, slightly serrulate, some faintly costate. Seta about 12 mm. long, red-brown, in the type plainly papillose with low distant papillae, in other specimens strongly roughened; capsule red-brown, about 2 mm. long, 3–4 : 1, "suberect, oval cylindrical," in other specimens inclined to horizontal, unsymmetric; operculum conic-apiculate; annulus of two rows of cells; segments nearly as long as the teeth, split between the articulations; cilia two, strongly appendiculate; spores smooth, 0.013 mm. California to Vancouver Id.

A fragment of Mitten's type from "The Northwest Coast, Douglas" has been accessible, and a specimen from the United States National Museum collected at Pasadena, California, by Dr. Palmer, and determined as *S. caespitosum* has been carefully compared with this fragment. The two agree in all essential particulars. The leaves of Dr. Palmer's specimen are more acuminate and more serrulate, the seta is rougher and the capsule more unsymmetric and inclined, but these differences are no greater than frequently occur in individuals of the same species. The seta in the type is much rougher than the original description would lead one to expect.

The leaf cells are much shorter than in most species of the genus, but in all other particulars it seems closely related to the other species.

Type in Mitten Herbarium.

SCLEROPODIUM CAESPITOSUM (Wils.) Br. & Sch. Bry. Eur. *pl. 556.* 1853.

Hypnum caespitosum Wils. English Bot. Suppl. *pl. 2878.* 1849. Also Bry. Brit. 344. *pl. 55.* 1851.
Hypnum caespitans C. Muell. Syn. **2:** 354. 1851.
Eurhynchium colpophyllum flagelliforme Barnes, Bot. Gaz. **16:** 207. 1891.
Hypnum lentum Mitt. Journ. Linn. Soc. **8:** 36. 1865.

Plants in rather thin loosely interwoven mats, light or dirty green; stems creeping, 5–10 cm. long, irregularly divided and branching; branches usually longer and more slender than in *S. illecebrum,* tapering, sometimes julaceous, but less frequently so than in *S. illecebrum;* branch leaves, from the middle of the branches 0.9–1 × 0.3–0.4 mm., ovate to oblong-lanceolate, usually tapering and acute at apex but sometimes nearly as obtuse as in *S. illecebrum,* appressed and imbricate to erect-open when dry, concave, scarcely plicate when moist, not decurrent, finely serrate at apex; median cells narrowly linear-vermicular, 8–12: 1;

quadrate basal cells in several rows, alar little differentiated from the other basal cells; apical cells broader and shorter; costa stout, frequently forked, extending three fourths the length of the leaf, often ending in a spine at the back of the leaf; stem leaves ovate to ovate-lanceolate, slenderly acuminate, with a larger number of short basal and alar cells; alar cells somewhat enlarged at the decurrent angles; inner perichaetial leaves loosely sheathing at base, gradually narrowed to a long subfiliform and suberect acumen, distantly and slightly denticulate above or sometimes entire, faintly costate. Dioicous. Seta 10–15 mm. long, red-brown, twisted to the right, very rough; capsule light brownish-green, oblong-cylindric, suberect, slightly unsymmetric, with operculum 2–2.5 mm. long, about 2.5 : 1; operculum conic-apiculate to conic-rostellate, often appearing short-rostrate when dry; annulus of two rows of cells, deciduous; teeth of peristome slender, subhyaline and slightly papillose at apex; segments nearly as long as the teeth, yellowish, more strongly papillose, from a wide basal membrane and widely open between the articulations; cilia two, very strongly nodose; spores rough, about .016 mm., maturing in winter.

Type locality, Langford, near Warrenton, England.

Growing on stumps and old logs, roots of trees and rocks. California, Washington, Oregon, Vancouver Island, Lake Athabasca (Macoun), Alaska (Kellogg).

Illustrations.—See above; also Dixon and Jameson, *pl. 153, B;* Husnot, Musc. Gall. *pl. 115; Pl. 11.*

Exsiccati.—As *Hypnum caespitosum;* Sull. & Lesq. Musc. Bor.-Am. 510; Macoun, Can. Musc. 290 (in part only. See under *S. colpophyllum*); Grout, N. Am. Musc. Pl. 168, 168a, 424; Musci Perfecti 39.

Sterile and robust *S. caespitosum* is hard to distinguish from *S. illecebrum.* In general it is more slender, less frequently julaceous with closely imbricated leaves, with tapering branches and narrower more gradually tapering leaves having their median leaf cells longer and rather narrower and the differentiated basal cells more numerous. It also comes very close to slender forms of *S. colpophyllum.*

Sullivant and Lesquereux's exsiccati (*l. c.*) do not agree very closely with Wilson's Musc. Brit. 349, or with the plate in the Bryologia Europaea. The stem leaves are too abruptly acuminate with too short an acumen. This is a variation in the direction of *S. obtusifolium,* but as these characters are variable according to Wilson's own description, these specimens should probably be referred to a form of *S. caespitosum.* Dr. M. A. Howe has collected a moss on "Redwood stumps, Mill Valley, Marin Co., California, January 16, 1892," that agrees very closely with Wilson's exsiccati, so that there can be no reasonable doubt of the identity of the European and American plant.

Var. sublaeve R. & C. Bot. Gaz. **15:** 61. 1890.

"Pedicel nearly smooth, slightly rough only below the capsule. Oregon, Suavies Island (Th. Howell)." M. Cardot very kindly sent me a portion of this for examination. It agrees with the typical form except as noted above.

Scleropodium colpophyllum (Sulliv.) Grout, Bull. Torr. Bot. Club **26:** 538. Oct., 1899.

Eurhynchium colpophyllum Sulliv. Icon. Musc. Suppl. 95. *pl. 71.* 1874.
Brachythecium colpophyllum Kindb. Can. Rec. Sci. **1894:** 73. 1894.
Eurhynchium Macounii Kindb. Rev. Bryol. **22:** 85. 1895.

Gametophyte in wide, soft intricate mats, dirty green; stems creeping, radiculose, about 5 cm. long, often stoloniferous, much elongated; branches numerous, erect, about 5 mm. long, terete-foliate, often julaceous; branch leaves closely imbricate when dry, erect-spreading when moist, not decurrent, oblong-lanceolate to broadly ovate-lanceolate, 1.3–1.5 × 0.45–0.6 mm., acute or broadly acuminate, serrate above, very concave, scarcely plicate; costa extending four-fifths length of leaf, ending in a spine on the under side; median leaf cells long-linear, 14–18 : 1; basal somewhat shorter and broader; a few of the alar cells quadrate; stem leaves triangular-ovate, long and slenderly acuminate, 1.3–1.8 × 0.8 mm.; perichaetial leaves with sheathing bases and loosely erect-open points, oblong-ovate, slenderly acuminate, costate, nearly entire. Dioicous. Seta about 15 mm. long, light brown, flexuous, twisted to the right, rough with rather distant conical papillae; capsule brown, oblong-cylindric, suberect, more or less arcuate, with the operculum about 2 mm. long, 2.5–3 : 1; slightly constricted under the mouth when dry; operculum conic-rostrate; annulus present, of two rows of cells, easily detachable; segments nearly as long as the teeth, widely split; cilia 2, strongly nodose or subappendiculate; spores minutely roughened, 0.012–0.016 mm., maturing in autumn.

Type locality, California, Bigelow. Type in the Gray Herbarium; examined by the author.

Not rare in California, but frequently confused with *S. caespitosum;* Vancouver Island, Macoun; Alaska, Kellogg.

ILLUSTRATIONS.—Sulliv., *l. c.* Evidently Sullivant did not figure any stem leaves, as those on the type specimen are quite different from any in the figure in the Icones. *Pl.* 12: *l*

EXSICCATI.—Grout, N. Am. Musc. Pl. 193, 392, 469; Musci Perfecti, 18.

This species is much nearer slender-leaved forms of *S. caespitosum* than is generally recognized. It is distinguished from *S. caespitosum* by its narrower more slenderly acuminate branch leaves, which are more sharply serrate, with median cells longer and narrower, enlarged basal and alar cells much less numerous. In gross appearance the whole plant, and particularly the branches, is much longer. It is undoubtedly a derivative of *S. caespitosum* and intermediate forms are not very rare.

Type specimens of var. *flagelliforme* Barnes have the shorter median cells and the more numerous differentiated basal cells of *S. caespitosum* and seem to me to belong to that species. The slender flagelliform branches are not rare in *S. caespitosum*.

Var. ATTENUATUM Grout, l. c.

Stoloniferous, much more slender with more distant loosely spreading leaves; leaves much narrower with a longer and more slender acumination; branch leaves varying from 1.7 × 0.54 mm. on the longer branches to 1 × 0.2 on the smaller.

Type from perpendicular rocks, Victoria, Vancouver Id., May 2, 1893, Macoun.

Type in the herbarium of the Geological and Natural History Survey of Canada at Ottawa.

SCLEROPODIUM CALIFORNICUM (Lesq.) R. & C. Rev. Bryol. **20**: 19. 1893.

Hypnum californicum Lesq. Trans. Am. Phil. Soc. **13**: 13. 1863.

Stems and branches very slender, subjulaceous; branch leaves ovate-lanceolate, concave below, slenderly acute to acuminate, more or less serrulate above; median cells linear-vermicular, about 12 : 1; quadrate basal cells very numerous, extending entirely across the base in several rows, rather larger and rounder next the costa; stem leaves somewhat broader and acuminate, nearly entire; costa stout at base, extending ⅔–¾ the length of the leaf. Seta about 1.5 cm. long, rough above, nearly or quite smooth below; capsule oblong-cylindric, cernuous. Type seen, from California, Bolander. Apparently rare.

No locations outside of California noted. The seta does not seem to be as smooth below as is indicated in the original description. Specimens from Santa Catalina Island (Bartram, 1017a) are mixed with *Camptothecium arenarium* and are difficult to distinguish without careful microscopic examination. The leaves of the Camptothecium are plicate while those of the Scleropodium are not noticeably so.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. Ed. 2. 511.

I22, MF I P2 125 C

CAMPTOTHECIUM Br. & Sch. Bry. Eur. fasc. 52–54. 1853

Plants of medium to large size, erect or ascending, densely foliate; stems with central strand; branching often regularly pinnate, green to glossy yellow-green; most leaves broadly to narrowly lanceolate and long and slenderly acuminate (excl. *C. megaptilum*), deeply plicate, costate to above the middle; median cells very long and narrow, 10–20 : 1; alar cells differentiated, usually quadrate and thick-walled; inner perichaetial leaves usually long-filiform acuminate. Dioicous in most cases. Seta rough in all our species except *nitens* and *paulianum*. Capsules oblong-cylindric, more or less curved, especially when dry; peristome perfect; operculum conic to conic-rostrate. Type species *C. lutescens*.

This genus is distinguished from Brachythecium by the longer capsule and longer leaf cells, from Scleropodium by the more plicate and more slenderly acuminate leaves and from Homalothecium by the more curved capsule and well developed cilia.

KEY.

1.	Stems densely radiculose throughout	*nitens.*
	Stems almost without radicles except where in contact with substratum	2.
2.	Plants plainly and regularly pinnate	3.
	Plants not regularly pinnate	6.
3.	Plants large, coarse, upright, reaching a height of 12 cm., branch leaves blunt	*megaptilum.*
	Plants much smaller, delicate, creeping	4.
4.	Stem leaves slenderly acuminate, costa rarely ending with more than one spine	5.
	Stem leaves acute to blunt, costa with several spines at back near the end	*alsioides*
5.	Branch leaves slenderly acuminate, costa without spines; capsule about 3 : 1	*pinnatifidum.*
	Branch leaves merely acute, costa often ending in a spine; capsules 5–6 : 1 when dry	*Amesiae.*
6.	Plants little branched, leaves strongly secund, giving the appearance of a Drepanocladus; seta smooth	*paulianum.*
	Plants branching freely, leaves rarely secund; seta rough	7.

7. Plants robust, with the habit of a large Brachythecium; alar cells thick-walled and dense; seta rough throughout ..... 8.
   Plants slender; quadrate alar cells numerous, extending across base of leaf; seta nearly smooth above ..... *arenarium.*
8. Branch-leaves slenderly acuminate ..... *lutescens.*
   Branch-leaves with "points broad" ..... *aeneum.*

CAMPTOTHECIUM LUTESCENS (Huds.) Br. & Sch. Bry. Eur., fasc. 52–54, *pl. 558.* 1853.

Hypnum lutescens Huds., Fl. Angl. 421. 1762.
Hypnum fulgescens Mitt., Bot. Zeit. **1858:** 170. (Douglas's specimen seen in the Mitten Herbarium.)
Hypnum pseudosericeum Muell., Regensb. Flora, **8:** 89. 1875.

Plants in loose spreading mats or tufts with the habit of one of the larger Brachythecia, green to light yellow-green, glossy, brownish below, rather stiff when dry; stems ascending, irregularly to subpinnately branching, cortical cells elongated-linear; leaves crowded, erect-open when moist, erect to appressed when dry; stem leaves slightly decurrent, elongated triangular-lanceolate, gradually narrowed from the base to a long-filiform apex, 2–3 mm. long, entire or nearly so, deeply 4-plicate, margins recurved below; costa extending ¾ the length of the leaf or more, occasionally ending in a spine on the back; basal and alar cells dense and thick-walled, often colored; the alar minute, rounded-quadrate; median narrowly linear, 10–15 : 1, basal shorter; branch leaves smaller, less plicate, the upper less slenderly acuminate and serrulate, frequently with very minute teeth on the basal margin, occasionally some have shorter and broader apical cells; perichaetial leaves numerous, the inner reaching 4 mm. in length, oblong below and more or less abruptly narrowed to a long-filiform acumination, as a rule coarsely dentate at the base of the acumination, thinly costate. Dioicous or pseudo-monoicous. Seta 2–2½ cm. long, rough with numerous very large papillae; urn 2–2½ mm., oblong-cylindric, sometimes almost erect and symmetric but usually somewhat curved, contracted under the mouth when dry and empty; operculum conic-rostrate, reaching 1 mm.; annulus of two rows of cells; peristome of the perfect hypnaceous type with segments about as long as the teeth, split along the keel, and with two long slender cilia; spores in late autumn and winter. Type locality English?

Most of the American plants are the:

Var. OCCIDENTALE R. & C. Robust, usually bright glossy yellow-green above; branch leaves usually less slenderly acuminate and more serrate; capsules 3–4 mm. long.

On trees, stumps, and logs; in Europe on calcareous rocks and dunes. Frequent west of the Rockies in the northern U. S. and Canada.

ILLUSTRATIONS.—Bry. Eur., l. c.; *Pl. 12.*

EXSICCATI.—Var. *occidentale.* Allen, Mosses of the Cascade Mts. 99; Grout, N. Am. Musc. Pl., 68, 68a.

CAMPOTHECIUM AENEUM (Mitt.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77.

Hypnum aeneum Mitt. Journ. Linn. Soc. **8:** 31. *pl. 5.* 1865.

Smaller than the last; cortical cells of branches somewhat quadrate-rectangular; leaves smaller and less plicate, acute to slenderly acuminate; stem leaves slightly decurrent; branch leaves shortly acuminate to acute, more strongly serrate; basal and alar cells less dense, upper cells of branch leaves shorter and broader, oblong; perichaetial leaves usually ecostate, otherwise as in the last. Seta less strongly roughened, especially above; capsule about as in *C. lutescens* except that the operculum is conic-apiculate, not rostrate in specimens seen in perfect condition; the capsule seldom, if ever, straight and erect; peristome perfect, often with three cilia as long as the segments; spores in winter. Type from the Pend d'Oreille R., B. C., Lyall.

ILLUSTRATIONS.—Mitten l. c.; *Pl. 14.*

EXSICCATI.—Allen, Mosses of the Cascade Mts. 97, Grout, N. Am. Musc. Pl. 204.

On rocks with the range of the last but less common. Black Hills, S. D., Montana, Idaho, Wyoming.

The apices of the branch leaves and the shorter operculum distinguish this from the last. It also seems to average smaller and the leaves are usually more appressed. The larger size, the leaf apices, and the more irregular branching distinguish it from *C. pinnatifidum.*

This evidently is a xerophytic derivative of *C. lutescens* and it is to be regreted that the species was not founded on the extreme variant which Cardot described as *C. dolosum* R. & C., Hedwigia **32:** 336. 1893, which is best classified as:

Var. DOLOSUM (R. & C.) Grout, Bryologist **31:** 43. 1928. Robust, branch-leaves broadly acute, especially the upper; costa broader and ending abruptly in the apex; leaf cells of apex even broader and shorter. *See* notes under *C. Amesiae.*

Var. ROBUSTUM Grout, l. c.

Very large and thick-stemmed, regularly pinnate, subcircinate when dry. On rocks, Shasta Springs, Calif. (M. A. Howe). N. Am. Musc. Pl. 30 is the type collection. Type, in herb. A. J. G. (30 was issued as *Camptothecium nevadense*).

CAMPTOTHECIUM PINNATIFIDUM (Sull. & Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876-77:** 315.

Hypnum pinnatifidum Sull. & Lesq., Mem. Calif. Acad. **1:** 33. 1868.

Plants in wide loose mats, usually a bright glossy green, often paler; stems slender, prostrate, brittle, closely and regularly pinnate; branches short, incurved when dry, sometimes attenuate, cortical cells quadrate-rectangular; leaves erect-open when moist, more or less appressed when dry; stem-leaves ovate-lanceolate to lanceolate, slightly decurrent, reaching 2 mm. in length, gradually and slenderly acuminate, usually slightly toothed at apex, somewhat plicate with borders recurved below; a comparatively large area of alar cells quadrate and larger and clearer than in any of the preceding; median cells reaching 75 μ, about 15 : 1; costa rather stout, extending about $\frac{4}{5}$ length of leaf; branch leaves smaller, less slenderly acuminate, more serrate at apex; inner perichaetial leaves elongated-lanceolate, reaching 3.5 mm., very long and slenderly acuminate, nearly or quite entire and ecostate. Seta 1.2–1.8 cm. long, rough throughout; capsule oblong or obovate, with operculum reaching 2 mm., cernuous and curved; operculum short-conic; annulus large; peristome perfect; segments as long as the teeth, open between the articulations; cilia 2, well developed; spores in winter. Type locality, in canyons, California (Bolander).

On soil and rocks, California to British Columbia, frequent.

ILLUSTRATIONS.—Sull. Icones, Suppl. 101. *pl. 77; Pl. 13.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am., Ed. 2, 513; Grout, N. Am. Musc. Pl. 28; Allen, Mosses Cascade Mts., 98.

Cardot states (Hedwigia **32:** 336) that *C. pinnatifidum* is merely a variety of the European *C. aureum* (Lag.) Br. & Sch., differing in its more slender and creeping stems and shorter capsules. He also states that similar forms are found in Southern Europe and that Roell's nos. 105a & 107 from Vancouver are completely identical with the European *C. aureum.*

CAMPTOTHECIUM AMESIAE R. & C., Bot. Gaz. **13:** 202. 1888.

Regarded by the authors (Hedwigia, l. c.) as a subspecies of the last, from which it differs in its broader and shorter pointed, more strongly serrate branch-leaves; costa thicker and spinose at the upper end, and the capsule usually longer. The branch leaves are ovate-lanceolate and slenderly acute rather than acuminate and the costa extends to within a few cells of the apex. Type, from Auburn, California (Mrs. Mary E. P. Ames).

On soil, rocks and bases of trees, California to Vancouver Island.

ILLUSTRATIONS.—R. & C., l. c.; *Pl. 12.*

EXSICCATI.—Baker, Pacific Coast Bryophytes, 374. [Although this was identified by Cardot himself (*"Forma foliis longius acuminatis"*) it is an intermediate form that seems to me to be nearer *C. pinnatifidum.*] Grout, N. Am. Musc. Pl., 416. This is also an intermediate form with branch-leaves more slender pointed than in the typical form.

Sterile, this is likely to be confused with *C. aeneum*, especially its var. *dolosum*, but it is typically smaller, more slender and much more regularly pinnate, and has a much larger area of clearer quadrate alar cells.

In fruit the slenderly acuminate entire perichaetial leaves and the more slender capsules will identify it. Sterile, it is also likely to be confused with *Homalothecium nevadense subulatum*, but in that plant all the leaves are very narrowly lanceolate.

CAMPTOTHECIUM ARENARIUM (Lesq.) Jaeger & Sauerb., St. Gall. Nat. Gesell. **1876-77:** 315.

Hypnum arenarium Lesq., Trans. Am. Phil. Soc. **13:** 13.

In wide loose mats, dirty yellow-green; stems slender, much as in *C. aeneum*, irregularly branching; branches short and erect, or longer and attenuate; cortical cells quadrate-rectangular, at least in part; leaves erect, imbricate; costa stout, extending into apex; stem leaves ovate-lanceolate, slightly decurrent, slenderly acute to acuminate, entire or slightly serrulate above, reaching 1.5 mm. in length, strongly concave at base like the base of a spoon; margins recurved below; median leaf cells narrowly linear, reaching 75 μ in length, 15–20 : 1; quadrate alar cells numerous and a band of similar cells extends entirely across the base of the leaf; upper cells sometimes papillose on back at angles; branch-leaves shorter and smaller, acute, sometimes slenderly so, and strongly serrate at apex; costa often extending almost to apex and ending in a spine or spines on the back; some of the inner perichaetial leaves abruptly narrowed into a filiform serrulate point, coarsely dentate below it. Seta 15 mm. long, rough toward the base, smoother above; capsule

ovoid-cylindric, urn about 2 mm. long, cernuous, curved; operculum conic-apiculate; annulus large, persistent; peristome perfect; segments as long as the teeth (?), split along the keel; cilia one or two, short. *Pl. 14.*

Type locality, near San Francisco, California.

EXSICCATI.—Sull. & Lesq., Musc. Bor. Am., Ed. 2, 512.

S. California, several locations, Santa Catalina Island (Bartram and Kingman); Washington (Frye). On shaded banks, often growing in sand.

CAMPTOTHECIUM ALSIOIDES Kindb. Pittonia **2:** 243. 1892.

Plants dark to bright green with much the habit of *C. pinnatifidum* except that they are less regularly pinnate; stem leaves broadly ovate-lanceolate, reaching nearly 1 mm. in length, acute to short acuminate, concave below with margins recurved, slightly decurrent, serrulate above; costa stout, almost percurrent, in all but the lower stem leaves ending in stout spines; median leaf cells linear, reaching 50 μ in length; quadrate basal and alar cells much as in *C. arenarium*, numerous, small and dense; branch-leaves smaller, lanceolate, almost obtuse, strongly serrate above; upper leaf cells papillose at the angles; *costa very broad and stout at the end and bearing several large spines;* "perichaetial leaves abruptly narrowed to a long subuliform denticulate acumen." Seta about 16 mm. long, rough; capsule subcylindric, curved; lid conic-apiculate; peristome perfect with cilia; segments split along the keel. Type from rocks, Mill Valley, Marin Co., California (M. A. Howe). Type duplicate seen but no sporophyte. *Pl. 14.*

Although this seems to be the only locality from which it has been collected the italicized characters are so distinct and so well marked that no difficulty will be experienced in recognizing it when typical, but, at best, it is only a subspecies of *C. arenarium* with which it apparently intergrades. It is more regularly pinnate and the costa in the branch leaves is more nearly percurrent and more strongly spinose, also the leaf cells are more papillose.

CAMPTOTHECIUM NITENS (Schreb.) Schimp. Syn. (Ed. 1) 530. 1860.

Hypnum nitens Schreb., Spic. 92. 1771.

Tomenthypnum nitens Loeske, Deutsch. Bot. Monatsschr. **20:** 82. 1911.

Plants bright shining green to golden brown; usually growing in deep masses, frequently among other plants; stems erect, 6–15 cm. tall, covered up to the latest season's growth with brown, much branched, intertangled radicles; subpinnately to irregularly branched; stem-leaves elongated-lanceolate, from a narrow base, crowded, erect, long and slenderly acuminate, 3–4 mm. long, deeply plicate; margin very narrowly recurved, entire or nearly so; costa extending ¾ the length of the leaf, often radiculose at back; leaf cells narrowly linear-vermicular, 50–75 μ, 10–15 : 1, a few at the base and angles short and thick-walled; branch-leaves smaller; inner perichaetial leaves gradually long and slenderly acuminate reaching 5 mm. long. Seta smooth, 2–5 cm. long; capsule oblong-cylindric, cernuous, curved; urn 2–3 mm. long, contracted under the mouth when dry and empty; operculum conic; peristome perfect with long cilia; spores in spring. Type, European.

ILLUSTRATIONS.—Bry. Eur. *pl. 622;* M. H. M. 296.

EXSICCATI.—Drumm., Musc. Am. 172; Sull. & Lesq., Musc. Bor. Am. 327, 486; Aust., Musc. Appal. 397, 308 var.; R. & C., Musc. Am. Sept. Exs. 321; Macoun, Can. Musc. 278 & 279; Grout, N. Am. Musc. Pl. 203.

In bogs and swamps in cool or elevated regions across the continent, south to New Jersey, Frequent but rarely fruiting.

CAMPTOTHECIUM MEGAPTILUM Sull., Icon. Musc. Suppl. 102. *pl. 78.* 1874.

"Plants highly cespitose," light green and glossy above, brown below, very large, reaching 15 cm. without radicles except at base, with habit of Hylocomium; branches distichous, reaching 1.8 cm. in length; leaves crowded, erect-imbricate; stem leaves triangular-ovate, acute to acuminate, strongly plicate with many folds, subdecurrent; two or three rows of basal cells short with walls much thickened and porose and perhaps another row or two of similar cells at the basal angles; median cells very long and narrow, linear-vermicular; branch-leaves ovate-lanceolate, with apex acute to rounded, concave and plicate with recurved margins below, sharply serrate above, serrulate below; costa extending well above the middle and toothed above on the back, as are some of the folds. Pseudo-monoicous. Seta very rough; capsules oblong, curved and cernuous; operculum conic-apiculate; peristome perfect with two long, appendiculate cilia; spores in winter. Type from Oregon, (Hall). *Pl. 13.*

On soil and over rocks in coniferous forests. Pacific coast, California northwards.

Exsiccati.—Allen, Mosses of the Cascade Mts., 101; Grout, N. Am. Musc. Pl., 23 and 23a.

Sullivant's plate, gives a misleading idea of the usual leaf form. In branch-leaves the apex is acute or rounded. The steam-leaves are very much broader than those of the branches.

Var. Fosteri Grout, l. c. 46. Branch leaves narrowly acuminate; stem leaves long-filiform acuminate, as in *Brachythecium albicans*, entire or with one or two sharp teeth above. Silverton, Oregon (A. S. Foster). *Pl. 14.*

Camptothecium paulianum Grout, Pub. Puget Sd. Biol. Sta. 3^{58}: 53. 1921.

Robust, bright yellowish-green. Apparently growing in a deep mass with erect stems. Stems 6–10 cm. long, irregularly and sparingly branching, not radiculose, colored when old; leaves strongly secund, giving the plant the appearance of a Drepanocladus; stem leaves lanceolate to ovate-lanceolate, reaching 4 mm. or more in length, not decurrent, costate to the base of the very long filiform acumen, nearly or quite entire, very strongly sulcate and plicate; leaf cells very long and narrow, 50–70 μ long, the walls nearly half as thick as the width of the lumen; alar cells broader and shorter, oblong to subquadrate; branch leaves similar, but often serrulate; perichaetial leaves lanceolate, reaching 6 mm. in length, long-filiform acuminate, serrulate above. Seta reaching 4 cm. in length, smooth; capsule oblong-cylindric, somewhat curved and cernuous, about 3 mm. long; operculum conic-apiculate; peristome immature but apparently perfect. Associated with *Tortula ruralis*. *Pl. 14.*

St. Paul Island (Kincaid, 1899). Type in herbarium of A. J. Grout.

HOMALOTHECIUM Br. & Sch., Bry. Eur. fasc. 46–47. 1851.

Very closely allied to Camptothecium, differing in little but the nearly or quite erect and symmetric capsule and imperfect peristome, in which the cilia are rudimentary or wanting and the segments are often reduced. Brotherus states in the second edition of Engler and Prantl that the inner peristome is attached to the outer in Homalothecium and makes this the distinction from Pleuropus. The attachment is so slight that it is scarcely mentioned, except by Limpricht, in the descriptions of European species and I have not detected it *H. nevadense*, hence I have included *Pleuropus Bonplandii* (Hook.) Broth., a recent addition to our flora from Texas. Type species *H. sericeum* (L.) Br. & Sch.

Key.

1.	Leaves dentate at base and often at apex with sharp, often recurved teeth	*Nutallii.*
	Leaves not dentate at base, very slender	2.
2.	Regularly pinnate, northwestern	*nevadense.*
	Not pinnate, southern, principally tropical	*Bonplandii*

Homalothecium nevadense (Lesq.) R. & C. Hedwigia, **32**: 334. 1893.

Hypnum nevadense Lesq., Mem. Calif. Acad. **1**: 33. 1868.

Plants in wide thin intricate mats with the habit of *H. Nuttalli*, pinnately branching; lower stem leaves elongated-lanceolate, reaching 2 mm. in length, somewhat decurrent, gradually very long-filiform acuminate, concave at base, plicate with lower margins recurved; median cells very long and narrow, about 60 μ long; a few basal cells shorter and broader and a small group of alar and decurrent cells quadrate, small; upper stem leaves broader and less slenderly acuminate, subserrulate; branch leaves smaller, less slenderly acuminate and serrulate at apex, occasionally with a few teeth on the margin of the area of quadrate alar cells; costa stout for the genus, diffusing into the apex and in the upper branch leaves almost filling it: perichaetial leaves oblong-lanceolate, the inner sometimes gradually long filiform acuminate, sometimes abruptly acuminate and coarsely dentate at base of acumination. Seta about 1.5 cm. long, rough, sometimes only slightly so above; capsule, oblong-cylindric when dry and empty, urn reaching 3 mm., nearly erect and symmetric; operculum rostrate; annulus present; segments of peristome slender, nearly or quite as long as the teeth, open between the articulations; cilia very rudimentary or wanting; spores in winter. Type from Yosemite, California. This species resembles *Camptothecium Amesiae* in general appearance and in the serrate branch leaves but is readily distinguished by the fact that all the leaves are very narrowly lanceolate. Its very narrow stem leaves and very slight or lacking serration of the basal margins distinguish it from *H. sericeum* and *H. Nuttallii*. From the var. *leucodontoides* of this latter it is more difficult to distinguish; see under the description of that form. Known from California to Washington, Idaho, Montana, and British Columbia. *Pl. 14.*

I have seen plants labelled in Lesquereux's handwriting but they scarcely correspond to this part of the original description, "Distinguished from *Hypnum lutescens* Huds. . . . by its larger thick stems and branches; . . . They are more regularly and deeply plicate than in any other Camptothecium." All the plants I have seen are distinctly more slender than in *Camptothecium lutescens* and the leaves are certainly not more plicate than in that species. He also indicates the differentiated alar cells as fewer than I find them. Cardot also claims to have seen specimens from the herbarium of Lesquereux that gave him substantially the same idea of the species as I have obtained. In perfect condition the oblong-ovoid capsule, distinctly larger at base, the rostrate operculum and lack of cilia in the peristome together with the narrow leaves, usually entire at base and strongly costate even into the apex of some of the branch leaves, enables one to recognize it with reasonable certainty. When dry and empty the capsules become cylindric. The plants are rather more robust than *Camptothecium pinnatifidum* and much less regularly pinnate.

Var. SUBULATUM R. & C. Hedwigia **32**: 334. 1893.

Homalothecium sericeoides C. Muell. & Kindb. Cat. Can. Pl. **6**: 175. 1892.

(Fide Barnes and Heald, Keys to N. Am. Mosses 335.)

This is a form with leaves longer acuminate, subulate and much less plicate. Some forms of the variety, notably a form New Denver, B. C., collected by Mrs. MacFadden and issued as No. 5 of the Supplement to my N. Am. Musci Pleurocarpi, have one or two rudimentary cilia.

EXSICCATI.—(Species) Allen, Mosses Cascade Mts. 100; Roell, Nordamerikanische Laubmoose, 696–699, 840 and 924, fide Cardot. (var.) Roell. 702–704 and 841, fide Cardot; Grout, l. c.

HOMALOTHECIUM NUTTALLII (Wils.) Grout, n. comb.

Hypnum Nuttallii Wils. Bryol. Brit. 334. 1855.

Camptothecium Nuttallii Bry. Eur. Camptothecium, 6. 1853.

Plants in wide rather thin intertangled mats, bright yellowish glossy green in the younger portions, turning progressively brown with age, densely and regularly pinnate with short, somewhat curved branches, having quadrate to short rectangular cortical cells; leaves erect, crowded, appressed when dry; stem leaves reaching 2 mm., somewhat concave and subclasping at base with margins recurved, elongated-triangular, gradually and slenderly acuminate, little striate, branch leaves more concave below with recurved margins, ong-lanceolate, coarsely dentate at base, serrate above; sometimes with sharp recurved teeth at the apex of some of the upper leaves; costa stout, vanishing in the apex; median cells narrowly linear vermicular, about 75 μ long, 20 : 1; alar quadrate, clear as in *Camptothecium pinnatifidum;* inner perichaetial leaves elongated-oblong, long-filiform acuminate, entire, occasionally toothed at base of acumen. Seta short, about 1 cm., very rough; capsules long-cylindric, suberect and somewhat curved, with a short distinct neck, reaching 3 mm.; operculum conic-rostrate; annulus narrow; segments of peristome slender, from a wide basal membrane, as long as the teeth, split along the keel; cilia short and rudimentary; spores in early winter. Type Menzies No. 53.

On trunks of trees, logs and less frequently on rocks. West coast from California to British Columbia, Idaho, Montana.

ILLUSTRATIONS.—Sull. Icones pl. 128; *Pl. 13.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. 338b and 514; R. & C. Musc. Am. Sept. Exsicc. 100; Grout, N. Am. Musc. Pl. (as Camptothecium) 24, 79, 238 and 351; var. *haemitidens* Kindb., 80; var. *tenue* Kinb. 381; Grout, Musci Perfecti 36.

Var. HAEMITIDENS Kindb. (*Hypnum haemitidens*) Bull. Torr. Bot. Club **16**: 97. April, 1889 is a form of *Nuttallii* more slender with the leaves hooked denticulate at apex. Dr. Bailey states that he has found the ordinary form on top of a log while at the sides where the water drips from the pendent stems and branches the var. *haemitidens* develops. I believe that many of the exceedingly variable forms from the Pacific Coast are due to the excessive dampness and heavy rainfall. Another example of a similar variation due to a similar cause is the variable and stoloniferous *Pseudisothecium stoloniferum* (Hook.) which has hardly two leaves alike on the same plant and is yet so near the European *P. myosuroides* that by many authors it is not considered distinct. In a series I have examined some specimens would have the recurved teeth on very few leaves while some would scarcely be serrate; on other plants the majority of the leaves were thus serrate.

Var. TENUE Kindb. is the extreme of the *haemitidens* variation and is well illustrated in Macoun's 473 and my 80. Cardot states [as quoted on the label of Baker's Pacific Coast Bryophytes no. 573 "*Camptothecium Nuttallii* form *leucodontoides* (Kindb.)"] that *C. leucodontoides* Kinb. Rev. Bryol. 1895 is only a simple form of *H. Nuttallii.* This form has the dentate leaves of *Nuttallii.* I agree with his conclusions but I think my specimen of 573 is *C. Amesiae.*

Homalothecium sericeum (L.) Br. & Sch., a common European species, is reported from the N. W. Coast and is so credited to N. America in the second edition of Engler & Prantl but I doubt its occurrence there. I have not yet seen a specimen from this region. The close relationship between this species and *H. Nuttallii* has seemingly not been noted. The leaves of *H. sericeum* are almost as sharply dentate on the basal

angles as in *Nuttallii* but the teeth seem to be principally on the margin of the area of quadrate alar cells. *H. sericeum* is, however, readily distinguished by its much more concave and strongly plicate leaves and very short segments of the peristome. Probably the report of *sericeum* from N. America is based upon an erroneous determination of a form of *H. Nutallii.*

H. corticola Kindb. Macoun, Can. Cat. **6**: 274. 1892 is to my mind a form of *H. nevadense.* A specimen from Vancouver collected by Macoun and communicated to N. Y. Bot. Gardens is so evidently depauperate and undeveloped as to make it unworthy of serious attention. It has the quadrate-rectangular cortical cells which are so characteristic of *H. Nuttallii* but it has not the dentate basal leaf-margin. This same type of cortical cells is also found in *Camptothecium pinnatifidum* and in *C. Amesiae* and the leaves of this specimen are very like short leaves of *Amesiae.* It does not fit the description at all and is evidently an error.

HOMALOTHECIUM BONPLANDII (Hook.) Jaeger & Sauerb., St. Gall. Nat. Gesell. **1876-77**: 379.

Pleuropus Bonplandii (Hook.) Broth. Engler & Prantl, Ed. **1**: 1138.
Leskea Bonplandii Hook. Kunth. Syn. Pl. Aequin **1**: 61.

Plants dark green, reddish or brownish, about the size of *Camptothecium lutescens* but with leaves rather more spreading; branching irregular to fasciculate; branch leaves erect-open very slenderly triangular-lanceolate, sometimes slightly secund, about 3 mm. long by 1.2 mm. wide, somewhat cordate and concave; apex very slender, subfiliform; at base rather lightly plicate when moist, strongly so when dry; serrulate all around; leaf cells narrowly linear-vermicular; a small area of alar cells oval to quadrate; costa rather slender, extending well into the apex. Seta about 1.5 cm. long, capsule narrowly ovoid-cylindric, erect and symmetric; operculum long-rostrate; cilia of the inner peristome rudimentary. *Pl. 14.*

Head of Guadelope River, Texas, alt. 2000 ft. Mrs. E. A. Harris. Com. Bartram. Collected April 1928, new to the U. S.; frequent farther south.

The distinction given by Brotherus to separate Pleuropus from Homalothecium is that in the latter the inner peristome is adherent to the outer. There is no evidence of this in the American species and few European authors mention it in describing the European forms.

HOMALOTHECIELLA Cardot, Bryologist **7**: 31. 1904.

Homalotheciella differs from Homalothecium in its small size and concave nonplicate leaves. From Brachythecium it differs in the hairy calyptra and imperfect peristome. The plants have almost the appearance of a Pylaisia. The resemblance is all the more striking because the segments of the endostome adhere to the teeth as in *Pylaisia intricata,* (Hedw.) R. & C. One cannot help wondering if the similarity between Pylaisia, Platygyrium and this species is not due to the fact of their having a similar habitat. May it not be that their approach in capsule to Leskea, Leucodon, Anomodon, etc., is due to the same cause?

HOMALOTHECIELLA SUBCAPILLATA (Hedw.) Card.

Burnettia subcapillata (Hedw.) Grout. Bryologist **6**: 65. 1903.
Pterogonium subcapillatum Schwaegr. Suppl. **1**: 107, 1811.
Pterigynandrum brachycladon Beauv. & Brid., in Brid. Musc. Recent. Part **4**: 130. 1819.
Pterogonium decumbens Schwaegr. Suppl. **2**: 32, pl. 110. 1823.
Lasia subcapillata Brid. Bryol. Univ. **2**: 202. 1827.
Homalothecium subcapillatum Sulliv. Gray's Man. Ed. **2**: 663. *pl. 5,* 1856, and Icones Musc. 41, *pl. 90.* 1864. See Plate 111.
Platygyrium brachycladon Kindb. Can. Rec. Sci. **21**: 1894.

Monoicous, in light-green, thin glossy mats; stems a few centimeters long, irregularly dividing, creeping, subpinnately branching; branches about 5 mm. in length; branch leaves often somewhat homomalous, loosely imbricate, ovate to elliptical-oblong, .9–1.2 × .3–3.5 mm.; abruptly long acuminate, more or less serrate above, smooth, concave; costa extending to middle or beyond; median cells linear-fusiform, 8–9 times as long as broad, quadrate alar cells about 10 μ wide, numerous, bordering the lower ¼ of the leaf. Stem leaves ovate, short- or long-acuminate, costa short or sometimes almost wanting; paraphyllia absent; perichaetium 1.5 mm. long, loosely sheathing, slightly spreading; inner leaves oblong to oblong-spatulate, gradually long-acuminate, serrate above, short-costate, loosely areolate, leaf cells at base rectangular to rhomboidal. Seta about 1 cm. long, rough, twisted to the right; calyptra cucullate, hairy; capsule brown suberect to horizontal, gibbous to slightly curved, with a narrow mouth, slightly constricted under the mouth, and lightly striate when dry and empty, 1.7 mm. long, length 2–3 times the diameter; operculum convex-conic, rostrate; collumella apparently not persistent; annulus of two rows of cells; peristome double;

the teeth linear-lanceolate, united at base, brownish-yellow, closely and regularly articulate, hyaline-margined by the adherent segments. Spores roughened, 25 μ, maturing in autumn.

Type locality, Pennsylvania. On bark of trees and decaying trunks, in woods. Widely distributed throughout the U. S. east of the Mississippi, but not very abundant.

ILLUSTRATIONS: Sulliv. l. c. & Icones *pl. 90;* Hedw. l. c., Suppl. *pl. 110* (*Pterogonium decumbens*) and *pl. 243* (*P. ascendens*); M. H. M. 298.

EXSICCATI.—Sulliv. Musc. Allegh. 83 (*Pterigynandrum*); Sulliv. & Lesq. Musc. Bor. Am. Ed. 2, 384; Aust. Musc. Appl. 295; Drummond Musc. Am. (S. States) 88; R. & C. Musc. Am. Sept. Exs. 236; Grout N. Am. Musc. Pl. 108.

The variation in length of leaf is due largely to the variation in the length of the acumination.

HOMALOTHECIELLA FABROFOLIA (Grout) Broth. Engler & Prantl, Musci 1133, Nov. 1908.

Burnettia fabrifolia Grout Bryologist 9: 44. May. 1906.

Closely resembling *B. subcapillata*, but with branch leaves broadly lanceolate to ovate-lanceolate, much more gradually narrowed to a longer and more slender acumination; median leaf cells about ⅕ larger, 60–80 × 8 μ, quadrate alar cells fewer and larger, about 16 μ wide; capsule less gibbous and less plainly narrowed at the mouth. *Pl. 14.*

On bark at roots of trees, near Thomasville, Ga. Coll. by Mrs. A. P. Taylor, Oct. 20, 1905. Type in the herbarium of the author. Co-type in the Herbarium of Columbia University. Sanford, Florida.

The fruiting plants were few and closely intermingled with *Raphidostegium adnatum.* In order that perfect capsules might be left with the type as few peristomes as possible were studied. One of these seemed to have the teeth united at base in pairs. I am greatly indebted to Dr. G. N. Best for assistance in the study of this plant, although he is in no way responsible for this publication. He said that this plant has the capsules of *Homalotheciella*, and the leaves of *Fabronia.* Calyptra not found.

(*Plate 2 continued.*)

× 45; 7*a*, apical cells of 9; 8, cells from alar region of 9; 9, branch leaf of *Bestia Breweriana* × 34. The line running from base to margin in 5 and 9 indicates not only the concavity of the leaf but the limits of the area of differentiated alar cells. Figs. 5–9, original drawings by Miss M. E. Vroom. The branch leaves of *Bestia longipes* are often shorter and broader than figured. Fig. 6 was drawn from plants of type collection communicated by Dr. M. A. Howe.

PLATE I. 1–3, *Porotrichum neckeroides*, from Hook. Musc. Exot. **1**: *pl. 58; 2*, portion of branch; 3, branch leaf, 3, a side view of the same.

5–9, *Porothamnium Bigelovii* after Sullivant; 3, 5, branch leaves, much enlarged; 6, 8, 9, areolation of the same.

7 and 10–15, *Girgensohnia ruthenica* after Sullivant. 7, plant × 1; 10, branch leaf; 11, 12, areolation of the same; 13, cross-section of stem with paraphyllia; 14, stem leaf; 15, capsule; 10–15 much enlarged.

PLATE 2. *a–l*, *Bestia Holzingeri* (after Cardot); *a*, entire plant; *b*, portion of a branch; *c*, *c*, lower stem leaves; *d*, *d*, upper stem leaves; *e*, branch leaves; *j*, areolation of apex of branch leaf; *l*, capsule with lid. Magnifications as indicated.

1–4, *Bestia longipes*, after Sullivant, Icones; 1, plant natural size; 2, branch leaf × 50; *2a* and *2b*, areolation of apex and base of leaf; 3, capsule with lid; 4, portion of peristome; 2–4 variously magnified; 5, branch leaf of *Pseudisothecium stoloniferum myurellum* × 34; 6, branch leaf of *Bestia Breweriana Howei*

(*Plate 2 continued on page 62.*)

PLATE 3. A, *Pseudisothecium myosuroides* from Bry. Eur. *pl. 534;* 1 and 2, plants natural size; 3*b*, stem leaf; 6, 7, 8, branch leaves. The other figures are self-explanatory.

Lower left, figs. 1–6, *P. stoloniferum* from Hooker, Musc. Exot. **1:** *pl. 74.* 1, plant × 1; 2, 2, branch leaves; 4, perichaetial leaf. The other figures are self-explanatory.

PLATE 4. 1–17, *Eurhynchium diversifolium* from Bry. Eur. *pl. 520;* 1, 2, female plants × 1; 1*b*, 1 enlarged; 3, male plant; 3*b*, portion of last magnified; 4, 4*a*, *b*, stem leaves, 5–9, branch leaves.

16–21, *Eurhynchium Rapii*, after Williams; 17, plants × 1; 20, 21, branch leaves × 40; 16, stem leaf × 50; 19, under side of apex of branch leaf × 125; median leaf cells × 325.

a–c, *Eurhynchium strigosum*, after Cardot; *a*, stem leaf of the European type; *b*, *b*, branch leaves of the same; *c*, capsule. *a***, stem leaf of *E. fallax;* *b***, *b***, branch leaves of the same.

*a**, stem leaf of *E. fallax Barnesii;* *b**, *b**, branch leaves of the same; *c**, capsule.

PLATE 5. Right half *Eurhynchium oreganum* after Sullivant, all much magnified. 1, portion of branch; 2 and 4, stem leaves; 3, 5, branch leaves; 7, portions of leaf showing cell outlines; 10, 11, 12, paraphyllia; 16, capsule; 18, perichaetium; 25, antheridia with paraphyses.

Left half, *Eurhynchium praelongum Stokesii* from Bry. Eur. *pl. 526.* 1, female plant; 2, male plant; 3, 4, 5, stem leaves; 7, 8, branch leaves; 9, 10, 11, paraphyllia. The other figures are self-explanatory.

PLATE 6. 1–23, *Cirriphyllum piliferum* from Bry. Eur. *pl. 531*. 1, plant × 1; 3, 3*x*, stem leaf; 4, 5, 6, branch leaves from middle, upper, and lower parts of the branch respectively; 3*a*, 3*b* areolation of apex and base of leaf; 11, 12, 13, perichaetial leaves. The other figures are self-explanatory.

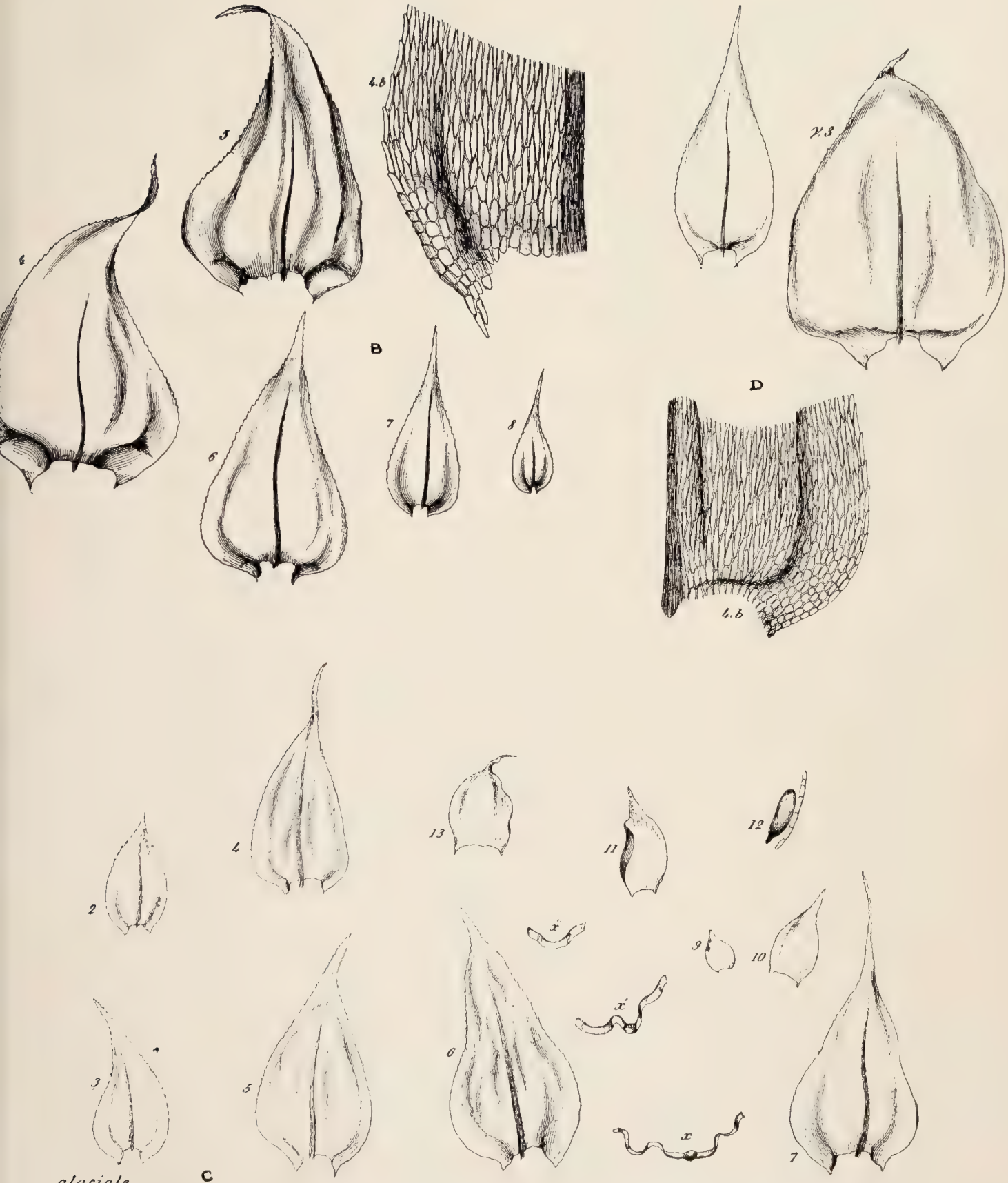
β 1*b*, β 2, and *x* Branch and leaf of *Cirriphyllum cirrhosum* from Bry. Eur. *pl. 530*.

PLATE 7. *A*, (bottom), *Brachythecium albicans* from Bry. Eur. *pl. 553;* 4–8, leaves; *b*, basal areolation; 12–14, perichaetial leaves.

B (left), *B. glareosum;* 6, leaves; 6*a*, 6*b*, apex and base of same more highly magnified. The other figures are self-explanatory.

C (right), 12–31, *B. petrophilum*, after Williams; 12, stem leaf; 31, branch leaves; 13, median leaf cells; 16, apical cells; 18, basal and alar cells; 15, capsules.

3*a*–3*e*, *B. beringianum* after Theriot; 3*a*, plant × 1; 3*b*, stem leaf × 26; 3*c*, branch leaves × 26; 3*d*, basal areolation × 135; 3*e*, median cells.



glaciale.

PLATE 8. C, 4–8, *Brachythecium Starkei* from Bry. Eur. *pl. 541;* 4–6, stem leaves; 4*b*, basal and alar areolation of same; 7, 8, branch leaves.

C (bottom), 2–13, *B. glaciale* from Bry. Eur. *pl. 542;* 4–7, stem leaves; 2, 3, branch leaves; 9–11, perigonial leaves; 12, antheridium and paraphysis; 13, outer perichaetial leaf.

γ^3. Stem and branch leaf of *B. rutabulum flavescens* from Bry. Eur. *pl. 544*.

D. 4*b*, basal and alar areolation of *B. campestre* from Bry. Eur. *pl. 545*. This is also representative of *B. salebrosum*.

PLATE 9. *A*, 4–8, *Brachythecium utahense* after Sullivant; 4, stem leaf; 5, 6, apical and basal areolation of same; 7, capsule; 8, peristome.

B, 1–10, *B. erythrorrhizon* from Bry. Eur. *pl. 547;* 2, 3, branch leaves: 4–7, stem leaves; 9, 10, perichaetial leaves.

C, 1*b*–17, *B. collinum* from Bry. Eur. *pl. 548;* 1*b*, portion of plant enlarged; 2–6, leaves. The other figures are self-explanatory.

PLATE 10. 1–7, *Brachythecium asperrimum* after Sullivant; 4, 4, branch leaves; 5, stem leaf; 6, basal and apical areolation of 5, much magnified. The other figures are self-explanatory.

c–l, *B. Nelsoni* from the Bryologist; *c*, capsule × 8; *d*, *e*, stem leaves; *l* and *m*, basal and median areolation of the same; *f*, *g*, *h*, branch leaves; *k*, large branch leaf.

1*a*–1*f*, *B. supasperrimum* after Theriot, Bot. Gaz. **37:** *pl. 24;* 1*a*, entire plant × 1; 1*b*, branch leaf; 1*b'*, stem leaf; 1*d*, 1*e*, basal and median areolation; 1*e'* cross section of seta; 1*f*, capsule.

8–12, *B. washingtonianum* from the Bryologist; 8, plant × 1; 9, capsule; 10, stem leaf; 12, alar cells of the same; 11, branch leaf.

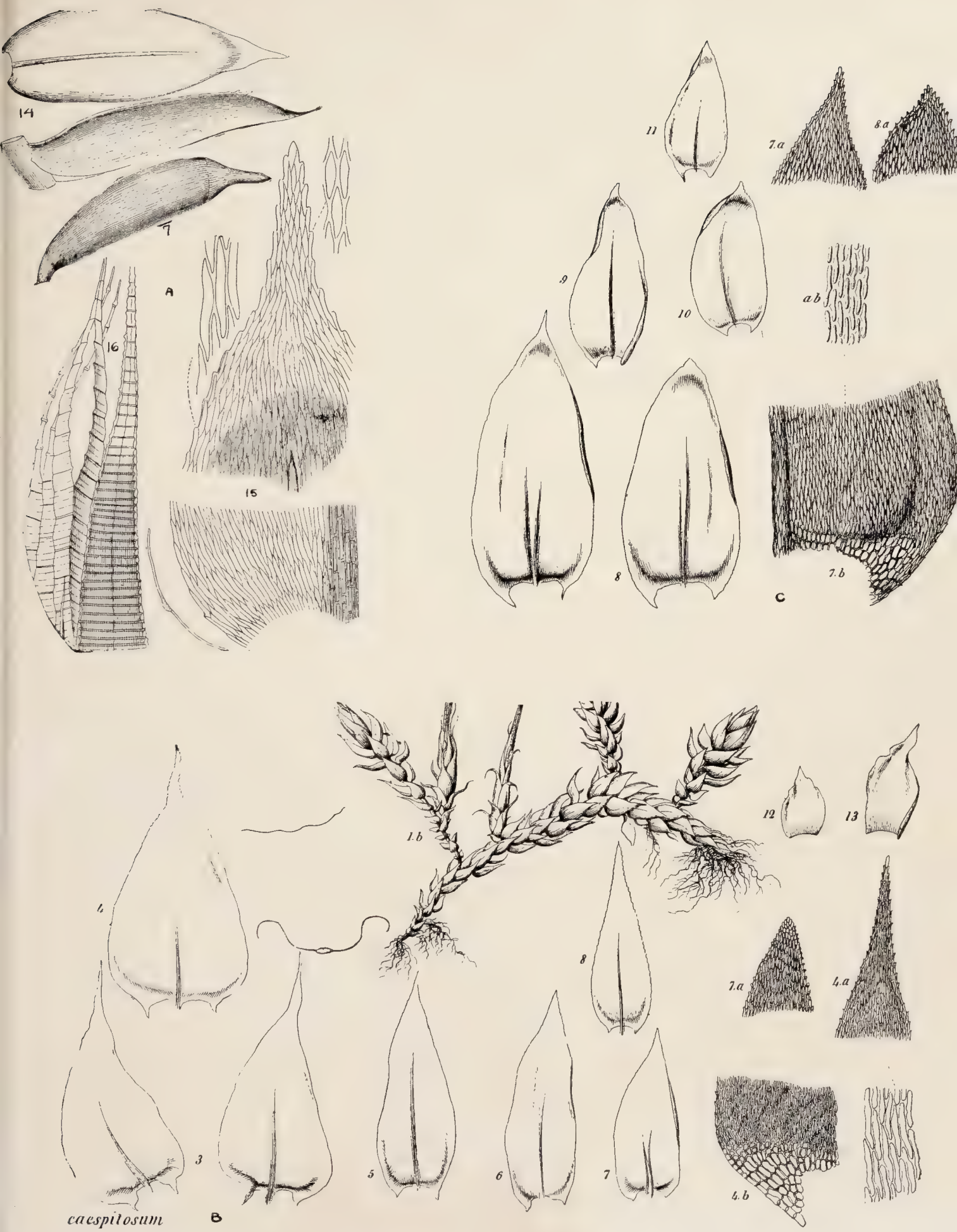


PLATE 11. *A*, 7–16, *Scleropodium colpophyllum* after Sullivant; 14, branch leaves; 15, apical and basal areolation of the same; 7, capsule; 16, peristome.

B, (bottom) 1*b*–13, *S. caespitosum* from Bry. Eur. *pl. 556;* 1*b*, portion of plant enlarged; 3, 4, stem leaves; 4*b*, 4*a*, basal and apical areolation of the same with a few enlarged median cells at right of 4*b;* 7*a*, apex of branch leaf; 12–13, perigonial leaves.

C (upper right), *S. illecebrum*, leaves and areolation.

PLATE 12. Left half, *Camptothecium lutescens* from Bry. Eur. *pl. 558;* 3, branch leaf; 3*b*, apex of same; 4, 5, stem leaves; 5*a*, 5*b*, base and apex same; 11, 12, perichaetial leaves. The other figures are self-explanatory.

Right half, 4*a*, 4*b*, 4*c*, leaf, alar and median leaf cells of *Brachythecium Bestii* after Theriot.

a', *b'*, *c'*, plant, lower branch leaf and basal cells of *Camptothecium Amesiae* after Cardot. The upper branch leaves are less acute as in *C. aeneum.* See *Pl. 14.*

b, *b*, leaves of *Brachythecium erythrorrhizon suberythrorrhizon; c*, basal areolation of same; *d*, *d*, apical cells.

PLATE 13. 1, 3–7, *Camptothecium pinnatifidum*, after Sullivant; 1, plant × 1; 3, portion of branch; 4, 4, stem and branch leaves; 5 and 6, apical and basal areolation of the same; 7, cross-sections of leaves. 14, Plant of *C. megaptilum* × 1; 2, portion of branch and of seta of same; 13, alar cells of same.

The other figures are of *Homalothecium Nutalii;* 8*a*, plant × 1; 8, leaves; 7*a*, cross sections of same; 4*a*, 5*a*, basal and apical areolation; beside 5*a* are magnified median cells numbered 6 by mistake.

PLATE 14. 1, stem leaf of *Camptothecium alsioides* × 50; 1*a*, back of costa much more magnified; 2, branch leaf of *C. alsoides* × 50; 2*a*, back of costa of same much more highly magnified (1 and 2 from type collection); 3, stem leaf of *C. arenarium* × 35; 3*b*, alar cells of same; 4, branch leaf of *C. Nevadense* with basal, median and apical areolation; 5, branch leaf of *C. aeneum* × 33, from the type; 5*a*, apical cells of same; 6, leaf of *Homalotheciella fabrofolia* × 12; 7, stem leaf of *C. paulianum* × 12, from the type; 8, lower branch leaf of *Scleropodium obtusifolium* × 12; 8*b*, alar cells of same × 100; 9, stem leaf of *C. megaptilum Fosteri* × 12; 10, small branch leaf of the same × 12; 11, leaf of *Homalothecium Bonplandii* × 12; 11a and 11b, apical and basal cells of 11; 12, stem leaf of *Brachythecium lamprochryseum* from Mt. Finlayson × 12.

Figures 1, 2, 3, 4, 5, and 12 by Miss M. E. Vroom. 6, 7, 8, 9, 10, and 11, camera lucida drawings by Miss Marjorie Eddy.

Lower portion, *Rhynchostegiella curviseta* from Bry. Eur. *pl. 509;* 3, plant × 1. The other figures are self explanatory.

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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VOLUME III

Part 2

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Subfamily AMBLYSTEGIEAE.

Plants of various habits and habitats; central strand always present in the stems (except *Hygrohypnum montanum*, *Drepanocladus vernicosus* and occasionally in other species); costa present (except *Campylium* and *Hygrohypnum* species and in *Calliergonella*). Paraphyllia rarely present (except in *Cratoneuron*). Leaf cells smooth, elongated, often narrowly linear (in *Amblystegium* species 2–3: 1), with few exceptions thin-walled; alar cells often enlarged and inflated. Capsules more or less curved and unsymmetric, usually cernuous; peristome perfect or in a few cases with poorly developed cilia. A large proportion of the species of this subfamily are aquatic or moisture-loving.

Key.

1. Leaves strongly bordered with thick-walled narrow cells	*4. Sciaromium.*
Leaves not bordered	2.
2. Paraphyllia abundant and striking	*5. Cratoneuron.*
Paraphyllia lacking or very few and inconspicuous	3.
3. Leaves having single costa to middle or beyond and slenderly pointed, with few exceptions falcate-secund	*12. Drepanocladus.*
Leaves not as above, those with single costa not falcate-secund (except *Hygrohypnum* forms); if secund, costa double or lacking	4.
4. Costa very strong and percurrent or excurrent	5.
Costa seldom reaching beyond middle of leaf, often short and double or lacking	7.
5. Leaves acuminate, usually very acute	6.
Leaves obtuse and rounded at apex or shortly apiculate, often cucullate	*9. Calliergon**
Leaves acuminate but obtuse at apex. Species of	*7. Hygrohypnum.*
6. Aquatic, growing chiefly on stones in streams	*3. Hygroamblystegium.*
Not aquatic, growing on various substrata, species of	*2. Amblystegium.*
7. Aquatic; leaves mostly obtuse or broadly acute with short or double costa.	8.**
Not aquatic, or if aquatic with slenderly acuminate leaves having a single costa	9.
8. Plants very large and dark colored, leaves rugose when dry; costa very faint and double or lacking	*8. Scorpidium.*
Plants medium to small; leaves not rugose; costa usually conspicuous	*7. Hygrohypnum.*
9. Plants small; leaf cells 2–3: 1. Species of	*2. Amblystegium.*
Plants medium sized to large; leaf cells 5–15: 1	10.
10. Leaves with single costa reaching the middle of leaf or beyond	11.
Leaves ecostate or with costa short and double	*11. Calliergonella.*†
11. Leaves acuminate and acute at apex	12.
*Leaves obtusely acuminate	*10. Calliergidium.*
Leaves broadly obtuse and rounded or apiculate at apex	*9. Calliergon.*
12. Leaves widely spreading to squarrose (except *polygamum*); costa in several species short and double or forking	*6. Campylium.*
***Leaves spreading to erect-spreading; costa always well developed and single.	*1. Leptodictyum.*

1. LEPTODICTYUM (Schimp.) Warnst. Laubm., Kryptogamenfl. Mark Brand. **2**: 840. 1906.

Leptodictyum Schimp. subgenus of *Amblystegium*, Syn. (Ed. 1) 595. 1860.

Plants small to large, growing in water or damp places, in rather loose mats, sometimes floating, attached to humus, stones, and wood, or less frequently found on soil. Leaves spreading to erect-spreading, *nearly or quite plane and entire on the margins; costa well developed, reaching the middle of the leaf or beyond, not percurrent;* median leaf cells *elongated-hexagonal to linear*, thin-walled. Sporophyte as in *Amblystegium*

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* Except *C. pseudosarmentosum.*

** *Leptodictyum riparium obtusifolium* and *L. vacillans* may be sought here, also *Drepanocladus* forms.

*** See also *Drepanocladus.*

† See also *Campylium.*

but sometimes smaller and with a shorter capsule. Differs from *Amblystegium* in the longer, thinner-walled leaf cells.

Type or standard species, *L. riparium.*

KEY.

1.	Plants usually aquatic and floating	6.
	Plants smaller, not floating, few aquatic	2.
2.	Stem and larger branch leaves broadly ovate to ovate-lanceolate, acute to acuminate; median leaf cells 3–6: 1	3.
	Stem leaves ovate-lanceolate to narrowly lanceolate; median leaf cells 5–10:1	4.
3.	Some or all of the leaves slenderly acuminate	5. *trichopodium.*
	Leaves acute to short-acuminate	2. *brevipes.*
4.	Leaves distant, separated by nearly their own width	3. *sipho.*
	Leaves not so distant, sometimes crowded	5.
5.	Apex of branch leaves rather blunt	4. *vacillans.*
	Apex of leaves slender (typical)	1. *riparium.*
6.	Leaves all gradually acuminate and acute. Varieties of	1. *riparium.*
	Many leaves, especially of the branches, obtuse	7.
7.	Plants small to medium in size; leaves 2 mm. long or less. Rare and confined to the northern U. S. and Canada	4. *vacillans.*
	Plants larger; leaves 3–4 mm. long. Common in the eastern U. S. from New England to Florida	1. *riparium obtusifolium.*

1. LEPTODICTYUM RIPARIUM (L. Hedw.) Warnst. l. c. 878.

Hypnum riparium L. Sp. Pl., 1129. 1753. Also Hedw. Sp. Musc. 241. 1801.
Amblystegium riparium Br. & Sch., Bry. Eur. fasc. 55–56, *pl. 570 & 571.* 1853.
Stereodon riparius Mitt. Journ. Linn. Soc. **8**: 43. 1864.
Amblystegium laxirete Card. & Thér. Bot. Gaz. **27**: 379. *pl. 25.* 1904.

Plants exceedingly variable in size and habitat, variations seemingly dependent in large measure upon the amount of moisture and the kind of substratum; typically creeping with long (±10 cm.) stems irregularly branching with rather short spreading branches, forming loose mats, or longer and floating in some of the varieties; stem leaves long (2–2.5 mm.), rather distant, *widely spreading both wet and dry*, often subcomplanate, *rarely* slightly secund at the ends of stem and branches, *with plane entire margins*, broadly ovate-lanceolate to elongated-lanceolate, slightly or not at all decurrent, somewhat clasping but not auriculate, *gradually tapering to the long slender acumination*, which typically ends in a single long narrow cell; costa strong at the base, extending ½–¾ the length of the leaf; leaf cells in the median region *narrowly linear-rhomboidal*, about 8μ *wide and 8–12* (rarely 15) times as long, thin-walled, towards the base gradually broader and shorter; basal and alar cells subrectangular, one or two at the margins often more elongated. Autoicous; sporophyte pale, yellowish to light brown, turning reddish; seta 1–2.5 cm. long; capsules oblong to cylindric, inclined and arcuate, reaching 2.5 x 1 mm., constricted under the mouth when dry and empty; operculum conic-apiculate; annulus broad; peristome perfect with cilia 1–4; "spores at all seasons" (Dixon).

Type locality, Thames River, England. "Type probably not in existence." (Cheney.)

ILLUSTRATIONS.—Br. & Sch. l. c.; Dixon & Jam. Handb. Brit. Mosses, *pl. 57;* Braithw. Brit. Moss Fl. *pl. 89;* Jennings, Mosses W. Pa. *pl. 38;* M. H. M. 339; Cheney, Bot. Gaz. **24**: *pl. 13, f. 1; Pl. 15 A figs. 3, 4, 5 & 6.*

EXSICCATI.—Drumm. Musc. Am. 170; Sull. Musc. Allegh. 54 and 56; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 349, (Ed. 2) 527; Aust. Musc. Appal. 387, 388; Macoun, Can. Musc. 325; Grout, N. Am. Musc. Pl. 163, 206 & 488; Ren. Card Musc. Am. Sept. Ex. 329.

Common in wet places across the continent. Apparently more common east of the Rockies. Represented in the southeastern U. S. chiefly by f. *obtusum.*

Under this species in my herbarium I found *L. trichopodium* var. *Kochii, Campylium polygamum, Drepanocladus Kneifii* and *Brachythecium acutum* and this diversity of determination was due, not to gross carelessness on the part of the sender but to a most striking resemblance to some of the forms of this species. Careful study will distinguish the *Brachythecium* by its slightly serrulate leaves on some parts of the plant and the darker capsules.

The *D. Kneifii* may be distinguished from f. *longifolium* by means of its inflated auricular cells alone. Forms of *L. riparium* of the smaller varieties are at times almost indistinguishable from *L. trichopodium* but in most cases *trichopodium* has broader and shorter leaf cells and more slenderly acuminate

leaves. *C. polygamum* is about the size of some of the smaller forms and varieties, but its leaf apices are channeled and the leaves are more or less auricled. To add to the confusion there are unusual forms of *riparium* with somewhat secund leaves (forma *subsecunda* Br. & Sch. l. c.) and I found one undoubted form of *riparium* with the margins of some of the upper leaves incurved so as to make the apex channeled.

Forma LONGIFOLIUM (Schultz).

Hypnum longifolium Schultz, Fl. Starg. 335. 1806.

This is one of the largest forms, yellowish green, turning dark with age, reaching 8 cm. in length, usually floating, little branched, leaves usually more distant and subcomplanate, 3.5–4.5 mm. long, rarely 5 mm., 0.6–0.7 mm. wide, with a *very long filiform acumination:* seta reaching 3–6 cm. Rarely fruiting. Common, probably with the range of the species.

ILLUSTRATIONS.—*Pl. 15 A, figs. 1 & 2.*
EXSICCATI.—Grout, N. Am. Musc. Pl. 50.
The basal, especially the alar cells of this variety are often somewhat swollen but they do not form auricles as in *Drepanocladus Kneiffii.*

Forma FLUITANS (L. & J.).

Hypnum riparium var. *fluitans* L. & J. Manual 377. 1884.

Very robust, 10–20 cm. long, floating in shallow water at edges of streams, dirty green or yellowish; leaves 0.8 x 3.2 mm., sometimes reaching 4 x 1 mm. lacking the extreme filiform acumen of var. *longifolium.*
Neither Cheney nor I have seen sporophytes. This is much less frequent than the preceding or the next variety.

Forma OBTUSUM (Grout) (as *Amblystegium*) Grout, N. Am. Musc. Pl. 471. March 10, 1917.

Robust, floating, scarcely to be distinguished from f. *fluitans* except for the bluntish apex of the leaf which much resembles that in *L. vacillans*, to which this form has often been referred, but this variety is much more robust and has fewer and less distinct alar cells; leaves 3 mm. long, occasionally reaching 4 mm., about .75 mm. wide; alar cells much as in the typical form, sometimes with elongated cells at the basal margin as shown in the illustration, but these are not inflated nor do they form auricles.

ILLUSTRATIONS.—Pl. *15. figs. 7, 8, 9, 10, 11.*
EXSICCATI.—Grout, N. Am. Musc. Pl. 355, type, from New Haven, Ct., Nichols, 465, 471.
This seems to be the most common floating form along the Atlantic seaboard, especially in the South. It is very common in Florida.

Forma FLACCIDUM (L. & J.)

Very much attenuated, filiform, sparingly branched; leaves distant about their own width, narrowly lanceolate and slenderly acuminate.
Type, N. American. Type not located, not to be found in James Herbarium, Harvard Univ.

ILLUSTRATIONS.—Jennings, Mosses W. Pa. *pl. 38; Pl. 16, figs. 1 a–z.*
EXSICCATI.—Drumm. Musc. Am. S. States 115. Aust. Musc. Appal. 389; Grout, N. Am. Musc. Pl. 113, 417; 295 is a form intermediate between species and variety.
It seems probable that this is the same form as the European var. *inundatum* (Schimper) Warnst.
Growing in water, generally in the shade, frequent.

Var. ABBREVIATUM (Br. & Sch.) Grout, l. c.

Amblystegium riparium abbreviatum Br. & Sch., l. c.

The smallest, most condensed form of the species. Typically with short stems and crowded leaves but more lax forms are found; leaves 1–2 mm. long: capsules short, sometimes only 0.8 mm. long, ovoid to oblong.

ILLUSTRATIONS.—Bry. Eur. *pl. 571, f. β 1–2.*
EXSICCATI.—Grout, N. Am. Musc. Pl. 178.
I think Sull. Musc. Allegh. 55 and Drumm., Musc. Am. S. States 117 are this variety.
Variety *abbreviatum* with its typically closely matted growth, small crowded leaves, short seta and capsule is so different from the large floating varieties as to make it seem foolish at first sight to include them in the same species yet a complete series of intergradations is present and subaquatic mosses are notoriously variable.

Var. BRACHYPHYLLUM (Card. & Thér.) Grout, l. c.

Amblystegium brachyphyllum Card. & Thèr. Minn. Bot. Stud. 3^2: 123, *pl. 20.* 1903.

I have seen the type collection sent me by Holzinger (near Granite Falls, Yellow Medicine County, Minnesota, near lat. 45° N., July 15, 1901). It differs in only one particular from the frequently occurring terrestrial form of the species with broad short leaves and wide leaf cells. It has many blunt-pointed leaves after the manner of f. *obtusum* and bears the same relation to the form with broad short leaves mentioned above that f. *obtusum* does to f. *longifolium*.

ILLUSTRATIONS.—*Pl. 16, f. 3 a–d.*

†Var. ELONGATUM (Br. & Sch.) Bry. Eur. l. c. One of our handsomest forms. The branches are usually complanate-foliate. The leaves a little less filiform-acuminate than in var. *longifolium*, crowded, imbricate and bright golden-yellow.

A form of this variety collected near mouth of Sand Coulee, Montana, has a sporophyte like a *Brachythecium* with short seta and short ovoid capsules. N. Am. Musc. Pl. 463 is typical of this variety.

As in so many subaquatic plants there is an extreme range of variation in this species due to habitat conditions largely, but even in similar habitats there seems to be great variation. In large floating forms f. *longifolium* has very long filiform-acuminate leaves, rather distant; if the leaves are a little less filiform-acuminate, crowded, imbricate and bright golden yellow it becomes var. *elongatum*.

If the leaves are a little shorter than in these two varieties with a normal apex it may be called var. *fluitans* and if many of the leaves have an obtuse apex it is f. *obtusum*. If the plants be very slender with distant leaves it is f. *flaccidum*. The costa sometimes extends almost to the apex of the leaf. Such forms are called var. *longinerve* by Cardot and Thériot.

The variation towards broad short leaves with wide cells produces numerous plants hard to distinguish from *L. trichopodium* and terminates in the subspecies *L. brevipes*. Sometimes these leaves may appear on the branches of plants whose stems have typical leaves as in *Pl. 15A, figs. 4 & 5* taken from plants of my N. Am. Musc. Pl. 295. Ordinarily these leaves seem to indicate a drier habitat but Dr. Conard sent me *L. brevipes* from the intake of a concrete water-tank in swift water.

From a large series of forms contributed by Dr. H. S. Conard from Illinois and Iowa, it seems that the terrestrial forms of this species from the midwest tend towards the *laxirete-brevipes* forms of leaf and leaf-cells. *Amblystegium laxirete* Card. & Thèr. (Bot. Gaz. **37**: 379, *pl. 25*. 1904) according to type material, description and figures differs from ordinary forms of *L. riparium* in nothing but the somewhat shorter and broader leaf cells, 60–80 x 12 μ, and very soft flaccid leaves.

Var. *serratum* (R. & C.) Grout, Check List, 13, can I think be safely ignored as a freak or more probably a form of *Brachythecium acutum*.

*2. LEPTODICTYUM BREVIPES (Card. & Thér.) Broth. Engler & Prantl. Musc. (Ed. 2.) **2**: 337. 1925.

Amblystegium brevipes Card. & Thér. Minn. Bot. Stud. 3^2: 124, *pl. 20*. 1903.

"Stems slender, creeping, with short branches. Leaves erect open, about 1.2 x 0.6 mm., broadly ovate, short-acuminate, entire; costa narrow, 30 μ wide at base, vanishing above the middle, often extending ⅔–¾ the length of the leaf, areolation lax; basal cells rectangular to quadrate, median subhexagonal, 55–70 x 12–15 μ, upper shorter and broader. Perichaetial leaves broadly ovate, abruptly contracted to a narrow acumen, often irregularly denticulate at base of acumen, costa extending beyond the middle. Seta about 1 cm. long; capsule ±1.5 mm. long, oblong-arcuate, constricted under the mouth when dry; operculum conic."

"This species differs from the small forms of *Amblystegium riparium* by the shortly acuminate leaves, the looser areolation, the shape of the perichaetial leaves, and the shorter pedicel" "Habitat" (of type) "near Montevideo," Minn. Also at Hartford, Minn.

ILLUSTRATIONS.—Card. & Thér. l. c.; *Pl. 15B, figs. 1, 2 & 3*, also *Pl. 16, figs. 2 a–h*.

Similar but less extreme forms are often found in collections under the name of *Amblystegium Kochii*. Dr. H. S. Conard collected a moss at the "intake of a concrete water tank" in swift water shaded by a roof "near Grinnell, Iowa, no. 405, Oct. 12, 1928," that seems clearly to belong here. J. L. Sheldon's 2343 from Short Creek, W. Va., June 21, 1906, is referred to this species. The costa of the perichaetial leaves in some cases was practically percurrent. Also Omaha, Neb., K. Wolfe no. 10.

*3. LEPTODICTYUM SIPHO (P. B.) Broth. Engler & Prantl, Musci (Ed. 2) **2**: 337. 1925.

Hypnum sipho P. B., Prod. 70. 1805.
Amblystegium riparium floridanum R. & C., Bot. Gaz. **14**: 98. 1889.
Amblystegium floridanum R. & C., Musc. Am. Sept. no. 58. 1893.

Plants light green, small; stems 1–2 cm. long, sparsely branched; leaves distant, narrowly lanceolate, 0.8–1.2 mm. long; stem leaves reaching 1.8 mm.; leaf cells about as in the broader-leaved forms of *L. riparium*. Seta about 1 cm. long; capsule 1–1.5 mm. long. Spores in spring.

† Probably identical with var. *splendens* De Not.

Type locality N. Carolina, Bosc.

ILLUSTRATIONS.—Cheney, Bot. Gaz. **24:** *pl. 13, f. 2;* Cardot, Bull. Herb. Boiss. **8:** 336. *pl. 10; Pl. 15C, f. 1–5 & Pl. 16, figs. 6 & 7.*

EXSICCATI.—R. & C., l. c.; Grout, N. Am. Musc. Pl. 248.

On decayed wood and humus in the South Atlantic and Gulf States. Common in Florida, probably elsewhere. Subspecies of *L. riparium*, combines the characters of *L. riparium abbreviatum* as to size and var. *flaccidum* as to shape and arrangement of leaves.

*4. LEPTODICTYUM VACILLANS (Sull.) Broth. l. c.

Amblystegium vacillans Sull. Icon. Musc. Suppl. 96, *pl. 72.* 1874.

Plants loosely cespitose, yellowish green, prostrate, sparingly branched, stems 2–6 cm. long, central strand poorly developed; stem leaves rather distant, erect-spreading, narrowly lanceolate, slenderly acuminate, reaching 0.7 x 2 mm.; branch leaves smaller, 0.35 x 1.2 mm., slenderly acuminate, rather obtuse at the apex, with entire plane margins; costa extending beyond the middle; median cells 30–50 x 7 μ. Monoicous; sporophyte not to be distinguished from that of the smaller forms of *L. riparium* of which this is at most a poorly delimited subspecies, distinguished by its small or medium size and the bluntish apex of the branch leaves. Forma *obtusum* of *L. riparium* has similar leaf apices but it is a much larger floating form. The two have often been confused.

Type from the White Mts. of New Hampshire. In a specimen of Oakes' New Hampshire collection in my herbarium the alar cells are like those figured by Sullivant rather than those figured by Cheney. The branch leaves have been described from one of Oakes' White Mt. plants.

ILLUSTRATIONS.—Sull. l. c.; Cheney, Bot. Gaz. **24:** *pl. 12, f. 4;* M. H. M. 340.

Owen Sound, Ontario, Moxley! ! Ogdensburg, Sussex Co., N. J. Aust. in Herb. N. Y. Bot. Garden and Bay of Quinte, Ontario, Macoun, 1868, determination doubtful. N. Am. Musc. Pl. 282 is *Calliergidium pseudostramineum* (Ren.) Grout. No. 458 proves to be an aquatic form of *Dicranella squarrosa.*

5. LEPTODICTYUM TRICHOPODIUM (Schultz) Warnst. Laubm., Kryptogamenfl. Mark Brand. **2:** 881. 1906.

Hypnum trichopodium Schultz, Fl. Starg. 324. 1806.
Amblystegium riparium var. *trichopodium* Br. & Sch. Bry. Eur. fasc. 55–56, *pl. 571.* 1853.
Amblystegium ambiguum De Not. Epil. Bry. Ital. 144. 1869.

Plants growing in loose wide tufts or mats, usually light green or yellowish, darker in the older portions; stems 2–4 cm. long, central strand present; branches prostrate to ascending-erect; stem leaves loosely to widely spreading, not crowded, slightly or not at all decurrent, often slightly serrulate by projecting cells on the plane margins, ovate to ovate-lanceolate, widest in the basal eighth, rather abruptly long-acuminate, 0.7–0.8 x 1.2–1.6 mm.; costa strong, reaching $^6/_7$ length of leaf, rarely almost percurrent, usually shorter; leaf cells thin-walled; median elongated hexagonal to rhomboidal, 9–12 μ wide and 3–5 times as long, becoming wider below, at base rectangular to oblong in several rows, angular cells scarcely different; branch leaves smaller and narrower, ovate-lanceolate to lanceolate.

Monoicous: sporophyte light brown, darker with age; seta 2.5–4 cm. long; capsule ovoid to oblong-cylindric, unsymmetric and cernuous or subarcuate, 2–3 x 0.75–1 mm.; operculum conic-apiculate; annulus present; stomata numerous; peristome perfect; spores from late autumn to early spring.

Type locality European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Cheney, Bot. Gaz. **24:** *pl. 12, f. 5;* Braithw. Brit. Moss Fl. *pl. 89; Pl. 16, f. 12.*

EXSICCATI.—Drumm. Musc. Am. (S. States) 189 as *Hypnum radicale*; Grout, N. Am. Musc. Pl. 48 (issued as *Hypnum chrysophyllum*).

Var. KOCHII (Br. & Sch.) Broth. Engler & Prantl, Musci (Ed. 2.) **2:** 337. 1925.

Amblystegium Kochii Br. & Sch., l. c. *pl. 568.*

While there seems to be no doubt that *trichopodium* and *Kochii* are not specifically distinct it is not so clear what is the distinction between the species and the variety. *L. trichopodium* has been described from specimens sent me by Loeske which he assures me have been compared with the original and found practically identical.

The form regarded as var. *Kochii* is well illustrated by the Bryologia Europea plate. Compared with *trichopodium* the stem leaves are more broadly ovate, costa thinner and not extending much beyond the

middle. Both species and variety are frequent across northern N. America, less frequent in the southern states of the U. S., Texas and Mexico.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 332.
EXSICCATI.—Drumm. Musc. Am. 189 (as *Hypnum radicale*).

Var. CURVIPES (Br. & Sch.) Broth. l. c.

Amblystegium curvipes Br. & Sch., l. c., *pl. 569.*

The extreme broad-leaved form with a short thin costa and softer leaves is credited to N. America by Brotherus. A form collected by Macoun at Lytton, B. C., April 17, 1889, is the nearest to this variety that I have seen. It was issued as *Hypnum hispidulum.*

Forma *robusta* Loeske Mss. has leaves reaching 2 mm. long and is often as large as *riparium.*

Forma *simulans* Grout **n. f.** is a form chiefly of the *Kochii* type, having a group of small subquadrate cells at the basal angles as illustrated in *Pl. 16, f. 11, a–c.* (See note on *Amblystegium Juratzkanum,* from which it is difficult to separate this form except by the larger size and the less slender branch leaves.) Type from Idaho, Heller. Type in Herb. A. J. G. Macoun's Can. Musci 844, determined Kindberg in herb. N. Y. Bot. Garden is close to this form.

I find this species and its varieties in swamps associated with *L. riparium* but in general it is less aquatic. Large forms are difficult to separate from the form of *L. riparium* with short broad leaves and wider cells like those drawn by Cardot to illustrate his *Amblystegium brachyphyllum.* At the other extreme it seems to fade into *Amblystegium Juratzkanum* and *A. varium. Juratzkanum* is usually smaller, with branch leaves more slender and more serrulate. *Varium* has a longer stronger percurrent costa and even shorter and smaller leaf cells, 3: 1. Either these species intergrade or hybridize and they certainly grow intertangled.

The form I have called the typical *trichopodium* is not the same as described by Limpricht. The form I have taken as typical with the strong long costa tends to have a row or two of somewhat inflated cells at the basal angles after the manner of *Hygroamblystegium irriguum.*

2. AMBLYSTEGIUM Br. & Sch. Bry. Eur. 1853.

Plants small, prostrate, creeping, often with erect or ascending* branches, dark to bright or yellowish green, irregularly and often freely branched, growing in moist places over various substrata, rarely aquatic; central stand present. Leaves spreading to erect when dry, usually equally spreading but rarely somewhat secund, more or less decurrent, ovate-lanceolate to lanceolate, acute to acuminate, serrulate to entire, costate to the middle or beyond, flat or somewhat concave but not plicate, with plane margins; leaf cells short, 5: 1** or less, basal cells shorter and broader, parenchymatous; alar often somewhat enlarged but not abruptly so nor forming auricles. Nearly always monoicous. Sporophyte large for the size of the plants; seta smooth; capsule inclined to horizontal, unsymmetric to arcuate, usually subcylindric, strongly curved and constricted under the mouth when dry, pale to dark brown, sometimes reddish; operculum conic, not rostrate; annulus usually present; peristome of the perfect hypnaceous type.

The small size of the plants, the short leaf cells and comparatively large capsules make the genus fairly easy to recognize. *A. Juratzkanum* grades into *Leptodictyum trichopodium,* but in most cases is distinguished by smaller size, shorter marginal leaf cells and more generally serrate leaf margins. Through *A. varium* this genus approached *Hygroamblystegium irriguum. Brachythecium reflexum* has the short cells of this genus but is distinguished by the triangular-ovate stem leaves, ovoid capsules and the rough seta. *Hygroamblystegium* is distinguished by the thicker costa and the aquatic habitat.

Type species *A. serpens.*

KEY.

1.	Costa not percurrent, usually ending near the middle of the leaf	2.
	Costa percurrent in some of the leaves, usually in all	3.
2.	Leaves usually widely spreading when dry; marginal cells at base of leaf oblong to rectangular	*2. Juratzkanum.*
	Leaves not widely spreading; marginal cells at base quadrate or transversely elongate	*1. serpens.*
3.	Leaves entire; costa strong; leaf cells 5: 1 or less	*3. varium.*
	Leaves serrulate; costa thin; leaf cells 6–10: 1	4.
4.	Plants usually in deep tufts or cushions, paraphyllia few or lacking	*4. compactum.*
	Plants in rather thick mats but not tufted; paraphyllia numerous	*5. americanum.*

* *A. compactum* usually grows in compact tufts like many of the acrocarpous mosses.

** *A. compactum* and *A. americanum* have leaf cells 6–10: 1.

1. AMBLYSTEGIUM SERPENS (L., Hedw.) Br. & Sch. Bry. Eur. fasc. 55–56, *pl. 564.* 1853.

Hypnum serpens L. Sp. Pl. 1130. 1753, and Hedw. Sp. Musc. 268. 1801.
Hypnum spinulosum Hedw. Spec. Musc. 269, *pl. 69, f. 5–10.* 1801.
Hypnum contextum Hedw. l. c. 273, *pl. 72, f. 5–12.* 1801.

Plants slender, the smallest of our species, growing in rather thin mats, more or less densely interwoven, irregularly branching, not glossy; leaves moderately close together as a rule, *not widely spreading;* stem leaves ovate-lanceolate, long-acuminate, reaching 1.2 x 0.4 mm., but usually smaller, branch leaves smaller and lanceolate, both serrulate to entire, narrowed at the insertion and slightly decurrent; costa slender, reaching to the middle of the leaf or somewhat beyond; median leaf cells oblong-hexagonal to hexagono-rhomboidal, 30–55 μ long, 3–4: 1, broader and subrectangular toward the base, *quadrate to transversely elongate at the basal margin.* Autoicous; seta 15–30 mm. long; capsule cylindric, curved and cernuous, contracted below the mouth when dry and empty; annulus of 2–3 rows of cells. Spores in spring.

"Type locality England. Type probably not in existence." Cheney.

Hedwig's type in Herb. Boissier?

ILLUSTRATIONS.—As above and Cheney, Bot. Gaz. **24:** 257, *pl. 11, f. 6.;* Jennings, Mosses W. Pa., *pl. 37;* M. H. M., 330.

EXSICCATI.—Sull. Musc. Allegh. 29 (a form close to the next). Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 345, (Ed. 2) 523; Aust. Musc. Appal. 373; Grout, N. Am. Musc. Pl. 145, 145a, 176 & 130 (as *A. compactum*).

Common on moist substrata of all sorts, especially decaying wood. Found all over the world. Not likely to be confused with any other species except the next, into which it unquestionably grades. The distinctions in the key usually hold good.

Var. TENUE (Schrad.) Bry. & Sch. l. c.

Hypnum tenue Schrad. Krypt. Gew. n. 80. 1796.

Exceedingly slender, filiform, with the habit of *Amblystegiella subtilis;* leaves distant, shorter, smaller and longer acuminate. Capsules small, often almost straight. Aust. Musc. Appal. 367 as *A. serpens tenellum* is this variety.

Var. BERINGIANUM Card. & Thér., Proc. Wash. Acad. Sci. **4:** 338.

"Differs from the typical form in the broader ovate-lanceolate leaves with shorter acumination, the costa stronger, extending to the base of the acumination, basal cells rectangular with thickened walls."

Type from St. Paul Island (Trelease, 2089 in part).

For var. *giganteum* Grout, Bryologist **12:** 96. 1909; see under the next species.

*2. AMBLYSTEGIUM JURATZKANUM Schimp. Syn. (Ed. 1) 693. 1860.

Plants in loose mats, bright green; *leaves widely spreading both wet and dry; stem leaves ovate to ovate-lanceolate, long and slenderly acuminate;* reaching 0.6 x 1.2 mm. in large forms; branch leaves smaller and narrower, narrowly lanceolate, more or less serrulate even to the base; costa extending beyond the middle, rarely almost percurrent; leaf cells oblong to linear-rhomboidal ± 10 x 60 μ, longer and narrower towards the apex, *short-oblong to rectangular at the base and basal angles.* Monoicous; seta and capsule yellow or light brown, scarcely distinguishable from that of *A. serpens.*

Type locality Austria. Type in Schimper's herbarium.

ILLUSTRATIONS.—Braithw., Brit. Moss. Fl. **3:** 25, *pl. 91;* Cheney, Bot. Gaz. **24:** *pl. 11, f. 7;* Jennings, Mosses W. Pa., *pl. 37; Pl. 16, figs. 11 a–b.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 358, 139 (this last contains *Campylium radicale* also); Aust. Musc. Appal. 384 in part, 374 is a form of this species.

Frequent throughout the northern U. S. and Canada on moist stones, soil and rotten wood. Less frequent southwards and in the Middle West; more abundant in the Far West.

The stem leaves are often much broader than figured by Cheney. Schimper in his original description says "e deltoideo-ovato." Braithwaite's figures are good.

A. Juratzkanum is at best a poorly delimited subspecies of *A. serpens.* It is usually larger, with more elongated marginal cells at base of leaf and longer and narrower leaf cells. The branch leaves are typically narrower, more slender and *more spreading* but all sorts of intermediate intergradations and combinations of these characters are found. Large forms in some cases are almost indistinguishable from *Leptodictyum trichopodium* var. *Kochii* but in most cases the leaves are more denticulate than in that variety.

Var. GIGANTEUM Grout **n. comb.**

Amblystegium serpens var. *giganteum* Grout, Bryologist, **12:** 96. Nov. 1909.

Stem leaves triangular-ovate to ovate-lanceolate, long-acuminate; often scarcely to be distinguished from *Leptodictyum trichopodium* and its var. *Kochii* except that the leaves are more abruptly narrowed to the insertion and somewhat concave and subclasping at base with a longer and more slender acumination; a few of the rectangular cells at basal angles are oblong-rectangular, then above these at the widest part of the base is a group of small quadrate cells at the margin which often extend ⅔ the way to the costa.

Type in herb. A. J. Grout, from Idaho, A. A. & Gertrude Heller, No. 2957. *Pl. 16, f. 11c.*

Forma *simulans* of *L. trichopodium* is very hard to distinguish from this variety. It is a parallel development.

Species of *Amblystegium* cannot accurately be distinguished without studying normal stem leaves. In this variety the characteristic alar cells are often wanting in the branch leaves and also in some of the stem leaves. Loeske, who has seen this form, referred it to *Juratzkanum* as a very large form and European plants of *Juratzkanum* sent me by him sometimes show a similar group of angular cells. All this goes to show that *Juratzkanum* is little more than a subspecies or variety of *serpens* and cannot be separated by the alar cells alone. If these cells were consistently present on all the stem leaves of each individual plant, var. *giganteum* might be regarded as a distinct species. This variety is a characteristic form of the Rocky Mts. and westward.

A careful study of this group of quadrate angular cells disclosed that they are found also in forms of undoubted *Leptodictyum riparium* (see N. Am. Musc. Pl. 295) and their presence or absence in this group is probably determined by habitat conditions.

3. AMBLYSTEGIUM VARIUM (Hedw.) Lindb. Musc. Scand. 32. 1872.

Leskea varia Hedw. Spec. Musc. 216. *pl. 53, f. 15–20.* 1801.
Hypnum radicale L. & J. Man. 373. 1884 (*not* P. B.).

Plants in mats of varying density, thin and loose to almost cespitose, younger portions light green, darker below the surface; stem leaves rather close together, loosely erect-spreading, averaging 1.2 x 0.5 mm., reaching 1.4 x 0.57 mm. in large plants, broadly ovate to ovate-lanceolate, narrowed at the insertion and somewhat decurrent, *rapidly narrowed to a long and comparatively slender acumen, entire or nearly so, slightly* concave but lying nearly flat when removed entire; *costa strong, tapering, reaching the apex or nearly so,* rarely stopping at base of acumen, leaf cells rhomboid-hexagonal, *2–4: 1, somewhat rounded at the ends,* toward the base *becoming rectangular, subquadrate at basal margins,* those near the insertion occasionally slightly colored but not opaque; branch leaves much smaller and less slenderly acuminate. Monoicous; sporophyte little different from the preceding species but often darker and reddish. Spores in spring.

Type locality, Lancaster, Pennsylvania.

ILLUSTRATIONS.—Hedw. l. c.; Br. & Sch. Bry. Eur. *pl. 565* (As *A. radicale*); Cheney, Bot. Gaz. **24:** *pl. 11, f. 10;* M. H. M. *pl. 78.*

EXSICCATI.—Sull. Musc. Allegh. 30; *Hypnum radicale,* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 345, (Ed. 2) 524; Aust. Musc. Appal. 390 (mixed with *A. Juratzkanum*) also 373 and 376. Grout, N. Am. Musc. Pl. 136, 177a, 139 (det. Cheney) near *Hygroamblystegium irriguum,* 372 near *H. irriguum;* Musc. Perf. 82; Drumm. Musc. Am. (S. States) 143 as "*H. radicale,*" approaches *Juratzkanum,* costa not percurrent in all leaves.

Common in moist shaded places on soil, at base of trees, decaying wood and even on stones, occasionally on limestone throughout our range. Exceedingly variable, particularly in size. The smaller forms simulate *A. serpens,* from which the percurrent costa distinguishes it in most cases. The larger size, shorter leaf cells and percurrent costa differentiate it from *A. Juratzkanum.* The more slender acumination and costa thinner, especially above, separate from most forms of *Hygroamblystegium irriguum;* yet there are intermediate forms between *A. varium* and each of the others that cannot be placed with certainty by any ordinary methods. One wonders whether carefully checked cultures could determine the origin of these puzzling forms.

Var. PARVULUM (Aust.) **n. comb.**

At first sight this is one of the most puzzling forms. The leaves are about ½ the normal size, 0.6 mm. ong, and but for the percurrent costa and more numerous quadrate alar cells, are indistinguishable from *A. serpens* or *Juratzkanum.* However, some plants in the tuft are pretty sure to show characteristic leaves.

Type, Aust. Musc. Appal. 378. *A. serpens radicale parvulum.* Undoubtedly frequent when the plants grow in an unfavorable situation.

Forma LAXUM **n. f.** Stem leaves distant, narrowly lanceolate, 1.2 x 0.25 mm.; leaf cells elongated, 2–3 times as long as normal, growing with more normal plants in damp shaded places, branch leaves sometimes nearly normal. Type from Valley Stream, Long Island, New York, in herb. A. J. G.; Indiana, Deam, no. 14587 is a most peculiar form growing by the borders of a lake mixed with normal plants. A hybrid? Aust. Musc. Appal. suppl. 542 as *A. serpens* var. *longifolium. Pl. 16, f. 10.*

Var. OVATUM Grout, M. H. M., 334. July, 1910, as forma *ovata.*

Slender, julaceous or nearly so; stem leaves smaller, 1.2 –1.5 mm. long, concave, round-ovate, abruptly and narrowly short-acuminate; leaf cells shorter, 2: 1; quadrate alar cells very numerous extending up ⅓ the margin of the body of the leaf.

Type from near St. Louis, Missouri, N. L. T. Nelson. no. 188 in herb. A. J. G.; on rocks in swamp, Bushkill, Pa., Bartram; Aust. Musc. Appal. 377 as *A. serpens radicale subjulacum. Pl. 16, figs. 8 a–b.*

Var. LANCIFOLIUM **n. var.** Leaves broadly to narrowly lanceolate, tapering almost uniformly from the widest part near the base to the apex; costa strong, about 35 μ wide at base. The stem leaves at times are almost perfect triangles except for the rounded basal angles, leaves have the outline of slender *irriguum* but the costa and texture is of *varium.* It is almost the only form of the species found in Florida, where it is common everywhere on sand, decaying wood, etc. Type from base of old Gamble Mansion, Ellenton, Florida, in herb. A. J. G.; N. Carolina, Texas, Louisiana. *Pl. 16, fig. 5.*

My N. Am. Musc. Pl. Suppl. 11 is an aquatic form of this variety from the concrete cistern of the Gamble Mansion with the characters of *forma laxum* intensified, the stem leaves reaching 1.9 x 0.36 mm. This is a floating form of this variety of *A. varium* as the variety *longifolium* is a floating form of *Leptodictyum riparium.*

Var. ALASKANUM Card. & Thér. Proc. Wash. Acad. Sci. **4:** 338. July, 1902.

"Very robust, densely branched, in broad depressed tufts, leaves very short, broadly ovate, constricted below, shortly and narrowly acuminate, alar cells much larger, inflated" From Muir Glacier (Trelease, 1752).

4. AMBLYSTEGIUM COMPACTUM (C. M.) Aust. Musc. App. 372. 1870.

Hypnum compactum C. M. Syn. Musc. Frond. **2:** 408. 1851.
Amblystegium serratum Br. & Sch. Bry. Eur. Ambly. 11. 1853.
Amblystegium dissitifolium Kindb. Macoun Cat. Can. Pl. **6:** 220. 1892.
Amblystegium subcompactum Kindb. l. c. 221.
Brachythecium densum Milde, Bot. Zeit. **1864:** 21.

Plants about the size of *A. serpens* but variable, pale green, *yellowish within the dense tufts, which may be 25 mm. deep* but are usually thinner, brittle when dry; stems irregularly branching, radiculose; many radicles minutely scabrous; leaves erect-open, narrowly decurrent, often slightly secund, ovate-lanceolate and about 1 mm. long on the stems, lanceolate on the branches and smaller, gradually and evenly narrowed to the slender acumination, *finely denticulate throughout on most leaves, teeth at base frequently recurved or double by the protruding angles of two adjacent cells;* margins plane; *costa wide, percurrent, frequently with radicles or delicate jointed brood filaments attached to the back of the costa;* leaf cells linear-rhomboidal, thin-walled, *40–60 μ long, 4–10: 1,* shorter toward the apex, shorter and broader toward the base, at the basal angles shortly rectangular to quadrate.

"Monoicous"; seta 1–3 cm. long; capsule 1.5–3 mm. long, oblong, *nearly or quite erect and symmetric,* constricted under the mouth when dry and empty; operculum conic-apiculate; annulus present, *cilia usually short or lacking; calyptra short, scarcely reaching below the operculum.* Spores in spring apparently.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 123;* Cheney, Bot. Gaz. **24:** *pl. 11, f. 8;* M. H. M. 331.

EXSICCATI.—Drumm. Musc. Am. 188 (the type); Aust., l. c.; Grout, N. Am. Musc. Pl. 130 (a portion of some specimens is *A. serpens*), 357 & 489 (as forma laxa); Musci Perfecti 127, R. & C. Musc. Am. Sept. Exsic. 125.

On decayed wood, base of trees in swamps and on stones, especially limestone, occurring across the continent from New York to the Pacific coast in the Northern U. S. and southern Canada; not rare but apparently local. Not reported from New England; Arizona; N. Mexico; California.

One of the easiest species of the group to recognize but varying widely in size and compactness. The next is at best a mere subspecies. The slender branchlets at times are almost flagelliform with leaves much like those of *Amblystegiella.*

5. AMBLYSTEGIUM AMERICANUM Grout, Bryologist **13:** 32. 1910.

Amblystegium Holzingeri Grout, Bryologist **12:** 97. 1909. Not R. & C.

Plants growing in rather thick wide mats, light olive-green, closely allied to *Amblystegium compactum* but *about twice as large, lighter colored and lacking the dense cespitose habit* typical of that species; stems 2–3 cm. long, irregularly to subpinnately branching, *bearing numerous multiform paraphyllia; stem leaves spreading to subsquarrose when dry,* ovate-lanceolate and gradually long-acuminate, about 1.2 × 0.3–0.4 mm.,

somewhat narrowed to the insertion, strongly and longly decurrent, concave, with basal margins more or less reflexed, serrulate all around to almost entire in the larger stem leaves; costa percurrent or vanishing in the apex, stronger than in *Amblystegium compactum;* median leaf cells oblong-linear, 45–60 × 6–10 μ, becoming shorter and broader toward the base; cells of basal angles subrectangular to quadrate; branch leaves smaller; minutely scabrous protonema frequent on costa of stem leaves; slender brood filaments not rare. Type from Trempealeau Ridge, Wisconsin, about ten miles south of Winona, on the Mississippi River, June 20, 1904, by Prof. J. M. Holzinger, who says this locality has produced many rare things. Type in Herb. A. J. G.; cotypes distributed as No. 335 of North American Musci Pleurocarpi. S. Dakota, McIntosh; Kamloops, B. C., MacFadden.

This is a subspecies of *Amblystegium compactum* and often has the peculiar teeth at base of leaves characteristic of that species, but its larger size, lighter color, and numerous paraphyllia, combined with several minor characters, sufficiently distinguish it.

The type collection is sterile and might easily be referred to *Brachythecium.* The brood bodies are not like any figured by Correns but I have seen similar ones on *Amblystegium compactum.*

Exsiccati.—Grout, N. Am. Musc. Pl. 335, which is also a type duplicate. No. 17 of the supplement is an intermediate form perhaps better referred to *A. compactum.*

3. HYGROAMBLYSTEGIUM Loeske, Moosfl. d. Harz. 298. 1903.

Plants aquatic or subaquatic, usually dark or blackish green, except at the ends of the growing stems and branches, not glossy. Stems irregularly branching, sometimes with a few paraphyllia near the junction of stem and branches, central strand well developed. Leaves erect-spreading, rarely slightly secund, often with tips incurved when dry, ovate to lanceolate with plane margins, entire to slightly serrulate; costa very strong, percurrent to excurrent; leaf cells thick-walled, rhomboidal to elongate-hexagonal, shorter and broader towards the base, becoming rectangular to quadrate; often a few alar cells somewhat inflated, basal and alar cells usually thick walled and colored. Sporophyte as in *Amblystegium.*

Amblystegium and *Cratoneuron filicinum* will be sought here.

Type species *H. irriguum.*

Key.

1. Leaves with the very strong costa excurrent in some or all of the leaves.....	2.
Costa strong and percurrent or nearly so.....	3.
2. Leaves having excurrent costa lanceolate, others often broader.....	1. *irriguum spiniforme.*
Leaves broadly oblong to triangular-ovate.....	4. *noterophilum.*
3. Leaves acute to subobtuse.....	4.
Stem leaves more or less long-acuminate.....	1. *irriguum.*
4. Leaves ovate to oblong-lanceolate, costa strong, little narrowed at the rather blunt apex.....	3. *fluviatile.*
Leaves ovate, acute, with costa somewhat narrower.....	2. *orthocladon.*

1. Hygroamblystegium irriguum (Wils.) Loeske, Moosfl. d. Harz. 299. 1903.

Hypnum irriguum Wils. Bryol. Brit. 361. *pl. 25.* 1854.
Amblystegium irriguum Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 566.* 1853.
Hypnum fluviatile of many early authors, not Swartz.
Hygroamblystegium tenax (Hedw.) Jennings, Mosses, W. Pa., 227, *pl. 39.* 1913.
Amblystegium serpens var. *irriguum* Aust., Musc. Appal. 375. 1870.

Plants medium-sized to large for the group, in rather wide intricate mats or in tufts, *dark olive to blackish green; stems rather thick and tough with a few paraphyllia near the insertion of branches; stem leaves elongate-triangular to triangular-ovate,* rather long-acuminate, "the point narrow and acute but not slender and rather rigid,"* narrowed to the insertion and slightly decurrent, ± 1 mm. long; branch leaves smaller and narrower, ovate-lanceolate to oblong-lanceolate, *gradually and evenly narrowed from the widest part to the acute apex,* occasionally somewhat secund, *all rather thick and rigid; entire or sinuolate, costa very thick and strong throughout, percurrent or merging into the apex,* usually much thinner toward the apex; usually (but not always) one or more rows of basal cells enlarged and somewhat inflated; median cells elongate-hex-

* Dixon.

agonal 9–20 μ long, 2–6: 1, becoming broader, subrectangular to quadrate, *thicker walled and colored near the base.* Monoicous; capsule subcylindric, strongly arcuate, contracted under the mouth when dry and empty. Spores in spring.

Type English, in Herb. Wilson.

Illustrations.—Br. & Sch. l. c.; Wils. l. c.; Cheney, Bot. Gaz. **24:** 268. *pl. 12. f. 1;* Jennings l. c.; M. H. M. 334.

Exsiccati.—Aust. l. c. also 376, 379; Sull. & Lesq. Musc. Bor. Am. (Ed. 1), 347 & (Ed. 2) 526; Grout, N. Am. Musc. Pl. 139 (as *A. Juratzkanum*, probably mixed), 182, 206, 247, 328, 342; Sull. Musc. Allegh. 30 (as *Hypnum varium*).

Typically aquatic, growing on stones in streams and along the edges of streams, ponds and in swampy places. Common in northeastern U. S. and eastern Canada, west to Montana and California, south to Georgia and Arkansas. Distinguished from most plants of *Amblystegium varium* by its stronger costa, triangular-ovate stem leaves, more incrassate and colored basal cells and more aquatic habit. Intermediate forms are not rare. *H. orthocladon* has shorter and proportionately broader leaves, acute to shortly acuminate. *H. fluviatle f. brevifolium* is much more like *orthocladon* in these respects.

As in all aquatic and subaquatic mosses there is a great range of variation in size and leaf form. In sterile unfavorable habitats this species develops slender stems with small distant leaves; if submerged the leaves may be narrowly lanceolate, costa thinner and vanishing (var. *tenellum* Sch.) or in other cases with short ovate leaves (var. *flaccidum* DeNot). These should be regarded as mere habitat forms and not given varietal rank. The European forms of this species are described as having serrulate leaves; in American forms they are mostly entire.

Var. spinifolium (Sch.) Grout, Check List. 14. Dec. 1929.

Stem leaves typically lanceolate with a thick excurrent costa in all the leaves but in many forms only the lower continually submerged leaves have the excurrent costa. In plate *16, f. 4a–b* are shown two leaves from different portions of the same plant. Probably with the range of the species; reported from Ohio, New Jersey, Pennsylvania, Ontario.

Type locality European.

Illustrations.—Cheney, l. c.; M. H. M. 334; *Pl. 16, figs. 4a–c.*

Exsiccati.—R. & C. Musc. Eur. Exsic. 92 (typical); Grout, N. Am. Musc. Pl. 438. (Only a portion of the leaves have the excurrent costa.)

I am led by a long series of observations to adopt Loeske's view that *Hygroamblystegium irriguum, H. fluviatile* and *Cratoneuron filicinum* have each developed parallel forms with a strongly excurrent costa. From *fluviatile* has come *noterophilum* and from *filicinum* has come an undoubtedly parallel European form known as *Amblystegium fallax* (Brid.)

In plants that in other respects seem to be well-characterized *irriguum* there are sometimes almost no enlarged decurrent alar cells, in others there is a well-defined basal area of larger, more or less swollen cells, usually very opaque and indistinct until cleared. Such forms seem to parallel forms of *Cratoneuron filicinum* and often have numerous paraphyllia and costa excurrent in some leaves.

Forma marianopolitanum Dupret, M. H. M. 336, seems to be form peculiar to cool springs or similar locations. One specimen from Lanesboro, Minnesota, Holzinger, has stems 4–6 cm. long, little branching until near the top; leaves broadly ovate-oblong, shortly acuminate, reaching 2 mm. in length by 0.8 mm. wide; costa more or less excurrent; cells larger, in the lower third much larger, reaching 60 × 15 μ in size. These leaves are evidently always submerged; those of the upper stem and branches are typical for the species. *Pl. 16, f. 9 a–b.*

The type is from near Montreal, and N. Am. Musc. Pl. 247 may be regarded as the type. When this form branches it can in most cases be easily distinguished from the parallel forms of *C. filicinum* by the fact that in that species the branch leaves are slenderly acuminate by the excurrent costa. This form is distinguished from all forms of *H. fluviatile* by the acutely acuminate stem leaves.

This form is also known from Missouri.

*2. Hygroamblystegium orthocladon (P. B.) Grout, Check List, 14. 1929.

Subspecies of *irriguum.* Plants smaller. Leaves broadly cordate-ovate, either gradually narrowed to a subobtuse apex or shortly and broadly acuminate, branches shorter; stem leaves shorter and relatively broader.

Illustrations.—M. H. M., 337.

Exsiccati.—Aust. Musc. Appal. 381; Grout, N. Am. Musc. Pl. 180 and 149 (as *Amblystegium fluviatile*), Musci Perfecti 53; R. & C. N. Am. Musc. Sept. Exsic. 246. (This is near *H. fluviatile brevifolium.*)

Intermediate between *H. irriguum* and *H. fluviatile brevifolium* and often difficult to distinguish from them. Possibly better treated as a variety of the widely variable *irriguum.*

Common on stones in brooks in elevated regions of New England and probably in similar locations throughout the range of *irriguum.* Arizona, Oklahoma, N. Carolina; Minn., Conard.

Forma BREVINERVE **n. forma.** Some leaves obtuse, costa in most leaves vanishing 6–12 cells from the apex. Raleigh, N. Carolina, Blonquist; Iowa, Pennsylvania, Conard.

Dr. Conard's series from the midwest indicate that in that region the costa of *irriguum* and *orthocladon* tends to stop short of the extreme apex.

3. HYGROAMBLYSTEGIUM FLUVIATILE (Sw.) Loeske, Moosfl. d. Harz. 299. 1903.

Hypnum fluviatile Sw. Musc. Suec. 63, 1799.
Amblystegium fluviatile Br. & Sch. Bry. Eur. fasc. 62–64. *pl. 567.* 1855.

Plants aquatic, floating, with long parallel branches, dark green or blackish; stem leaves oblong-lanceolate to oblong-ovate, *not so much broader below as in most species*, scarcely narrowed to the insertion, not decurrent, *more gradually tapering to a blunt point, entire*, concave and occasionally plicate; *costa very stout, percurrent and merged into the apex, typically nearly or quite as broad above as below;* area of enlarged and rectangular cells at base larger than in the preceding, *these basal cells thick-walled and often colored*, opaque or pellucid; median and upper cells hexagonal-rhomboid, *4–6: 1*, or even longer, *very chlorophyllose and more or less indistinct;* capsules light reddish brown, very long, narrowly cylindric, suberect, somewhat unsymmetric but scarcely arcuate before dehiscence, after dehiscence more curved, strongly contracted under the mouth when dry. Spores in spring.

Boulay separates the species into two forms, namely f. *typicum* and f. *brevifolium*. Forma *typicum* with leaves reaching 2 × ⅔ mm., oblong-lanceolate, loosely imbricate, often somewhat plicate, lower cells little colored. This form is apparently infrequent. The Bry. Eur. plate represents Boulay's forma *typicum*.

Boulay, Musc. Fr. 73, 1884 not var. brevifolium Ren & Car. Bot. Gaz. 30: 22 (see MF III 2

Forma BREVIFOLIUM, leaves oblong-ovate, 1¼ × ½ mm., tapering to a wide subobtuse apex, concave, basal cells often deeply colored and opaque.

According to M. Cardot's figures of specimens supposed to be from the type locality, this is probably the typical form (see Fig. 175), and it certainly is the more common form with us. It grades into the form which M. Cardot and I believe to be *H. orthocladon* (P. B.) and which is clearly intermediate between this species and the last, merging into both with such a series of intergrading forms that it is impossible to tell where one leaves off and the other begins.

Type Swedish, in herb. Swartz, at Stockholm.

ILLUSTRATIONS.—Br. & Sch. l. c.; Cheney, Bot. Gaz. **24:** *pl. 12, f. 2;* Jennings, Mosses W. Pa., *pl. 39;* M. H. M., *pl. 79.*

EXSICCATI.—Aust. Musc. Appal. 386; Grout, N. Am. Musc. Pl. 180. (A small form of *f. brevifolia* close to *orthocladon*, R. & C. Musc. Am. Sept. Exsic. 247 (f. *brevifolium*) also Drumm. Musc. Am. 138, as *Hypnum orthocladon.*

On rocks and earth in and along streams. Newfoundland to Minnesota, south to New Jersey. North Carolina (*f. brevifolium*).

The shape of the leaves, the bluntish apex made up mostly of the disappearing costa and the nearly simple branches, distinguish this from the two preceding except the forma *marianopolitanum*. See distinctions under description of that form. In the field the hand-lens will usually distinguish it by its greater size but the smaller forms of *f. brevifolium* need careful microscopic study.

Var. OVATUM **n. var.** Stem leaves broadly ovate to ovate-oblong, ± 1.2 × 0.6 mm., apex broad, obtuse; costa stout reaching the apex in very few cases; branch leaves smaller, broadly ovate, costa stopping ⅔ the distance from the base to apex in some cases. Sporophyte normal.

Type from "near West Chester, Pa., on stone in creek, May 15, 1904," Francis Windle. Type in herb. A. J. G. A unique and interesting form in perfect fruiting condition. Had it not been for the typical sporophyte and the costa normal in a few leaves, I should have doubted its relationship to this species. *Pl. 16, f. 13.*

*4. HYGROAMBLYSTEGIUM NOTEROPHILUM (Sull.) Warnst. Krypt-fl. Mark. Brand. **2:** 884. 1906.

Hypnum noterophilum Sull., Musc. & Hepat. U. S. 78. 1856.
Amblystegium noterophilum Holzinger, Bull. Geol. & Nat. Hist. Surv. Minn. **9:** 293. Nov. 1895.
Hypnum irriguum spinifolium L. and J. Man. and others.

Subspecies of *H. fluviatile. Plants normally the largest and coarsest of the genus, very dark dull green except at the young and growing tips, harsh and rigid*, prostrate or ascending when out of water, when submerged floating, irregularly branching, often profusely so; central strand well developed, cortical cells in three or four layers, thick-walled.

Leaves of submerged plants usually oblong-lanceolate *with a very thick excurrent costa*, in emergent plants becoming shorter and relatively broader, ovate to broadly triangular-ovate, reaching 2.4 mm. in

length and 0.9 mm. in breadth in large plants; *leaf blade very commonly of two layers of cells in the basal sixth and along the costa towards the tip*, margin usually entire. Capsules produced only on plants not submerged; *stomata very numerous, 90–200 to the capsule*—often clustered. Otherwise much as in *H. fluviatile*. Spores in June.

Type locality, Franklin Co., Pennsylvania.* "Type in herb. Sullivant, Cambridge."

I have referred to this subspecies plants evidently derived from both the typical form of *fluviatile* and from f. *brevifolium* and some that may possibly be more closely related to *H. orthocladon* than to either. I find numerous forms in which the strong costa is excurrent in only a portion of the leaves, usually the lower but in Sull. & Lesq. Musc. Borx. Am. (Ed. 1), no. 348 (which evidently represents Sullivant's idea of the species) the costa is very strong and excurrent in all the leaves, which are well illustrated in Cheney's drawings.**

Illustrations.—Cheney, Bot. Gaz. 24: *pl. 12, f. 3; Pl. 17B.*

Exsiccati.—Sull. & Lesq. l. c.; Aust. Musc. Appal. 385 as *Amblystegium serpens irriguum noterophilum;* Grout, N. Am. Musc. Pl. 179 & 487.

In springs and small streams, especially those containing lime, across northern U. S. to Montana; Ontario; local and infrequent. N. Am. Musc. Pl. 487*** is the extreme coarse rigid form with costa nearly ⅓ the width of the leaf at base and a considerable part of the lamina more than one cell in thickness. That *H. noterophilum, H. irriguum spinifolium* and *Cratoneuron fallax* all three have unusually large and persistent costae that often remain after the rest of the leaf has vanished and all seem inclined to be calcicolous raises the question as to whether the lime is to any extent causal of this structural peculiarity.

I have seen the type collection of *Amblystegium montanae* Bryhn (Bryologist 5: 26. 1902) and I do not think it belongs to *Hygroamblystegium*, even though it has in some ways a striking resemblance to *H. orthocladon*, because of the strongly recurved leaf margins and very thick-walled cells. I do not think it is *Leskea polycarpa paludosa* because the leaf cells are twice as long as wide.

I consider it a *Leskea*, L. montanae (Bryhn) **n. comb.** The drawings accompanying the description in the Bryologist do not adequately represent the plant.

4. SCIAROMIUM Mitt. Journ. Linn. Soc. **12:** 571. 1869.

This genus closely resembles *Hygroamblystegium* in appearance, habit, habitat and general structure. It differs chiefly *in having the leaves bordered by a thickened margin composed of a bundle of elongated thick-walled cells;* leaf cells otherwise small, short and thick-walled. Usually dioicous; sporophyte darker than is usual in *Hygroamblystegium* inclining to chestnut.

Type species *S. conspissatum* (Hook. & Wils.) Mitt.

Several species are found in S. America but we have only one.

Sciaromium Lescurii (Sull.) Broth. Engler & Prantl, Musci (Ed. 1) 1030, *f. 741.* 1908.

Hypnum Lescurii Sull. Mosses of the U. S. 79. 1856.

Amblystegium Lescurii Jaeger & Sauerb. St. Gall. Nat. Gesell. **1877–78:** 554.

Plants in loose dirty mats, dark to blackish green except for the bright green new shoots, irregularly branched; *leaves thick and rather opaque*, erect-spreading when moist, usually loosely appressed when dry; stem leaves broadly cordate-ovate to oblong-ovate, abruptly short-acuminate to subobtuse, subserrulate above or sometimes nearly to base, 1–1.3 mm. long; branch leaves proportionately narrower, *ovate-lanceolate to lingulate, often obtuse;* median leaf cells oblong-hexagonal to short-rhomboidal, 15–20μ long, 1–3:1; basal and alar cells more or less rectangular; *border of 4–5 rows of linear-flexuous thick-walled cells, gradually becoming thinner and of shorter cells toward the base and apex; costa very strong, reaching 60 μ in width, merging into the border at the apex.*

Sporophyte reddish; capsule 2–3 mm. long, curved and cernuous; operculum conic-apiculate. Spores in spring.

Illustrations.—Sull. Icon. Musc. *pl. 24;* Jennings, Mosses W. Pa., *pl. 39;* M. H. M. 341.

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 350.

Grout, N. Am. Musc. Pl. 150, 150a, 316. Also no. 52, issued as *Amblystegium irriguum*, contains in some packets considerable of the obtuse-leaved form of this species.

On stones in streams especially in elevated regions but found almost at sea level at Magnolia, Mass. and Cold Spring Harbor, Long Island, New York; often accompanying *Hygroamblystegium* species. Eastern U. S. and Canada, south to Georgia and Alabama, west to Ontario and western Pennsylvania.

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* Cheney!

** See note under *H. irriguum spinifolium.*

*** This is from Lanesboro, Minn., not New Jersey as the label states.

In many plants the branch leaves are more obtuse than figured by Sullivant, and in the plants mixed with my 52 the stem leaves also are obtuse.

5. CRATONEURON (Sull.) Roth, Hedwigia **38**: 6. 1899. (in part).

Hypnum, subgenus *Cratoneuron* Sull. Musc. & Hepat. U. S. 73. 1856.

Plants rather large, loosely tufted, bright to yellowish-green, irregularly branched to regularly pinnate, not glossy, prostrate to suberect; *stems without central strand** (except in *C. filicinum*); *paraphyllia usually numerous and of various shapes.* Leaves in most species plicate and more or less secund and decurrent; stem leaves triangular-ovate, with plane, more or less serrate margins; costa strong, frequently percurrent or even excurrent; leaf cells narrowly prosenchymatous, smooth in our species (except as noted in key); alar differentiated, often inflated and forming auricles. Dioicous; seta and capsule reddish; capsule cernuous to horizontal, cylindrical, more or less arcuate, narrowed under the mouth when dry and empty; annulus present; operculum conic-apiculate; peristome of the perfect hypnaceous type. More or less calciphile and aquatic.

Type species, *C. filicinum.*

KEY.

1.	Leaves neither plicate nor circinate	2.
	Leaves plicate, often circinate and crispate	3.
2.	Leaves with large decurrent auricles of inflated cells; costa usually ending in apex, rarely slightly excurrent	*1. filicinum.*
	Leaves with only a few enlarged alar cells; costa strongly excurrent in most leaves	*1. filicinum aciculinum.*
3.	Leaves more or less papillose	4.
	Leaves not papillose	5.
4.	Stem leaves broadly deltoid, nearly or quite as broad as long; median leaf cells 4–5: 1	*4. decipiens.*
	Stem leaves elongated-triangular, 2–3: 1: median leaf cells 7–9: 1	*5. papillosum.*
5.	Stems very radiculose; branching regularly pinnate as a rule	*2. commutatum.*
	Stems scarcely radiculose; branching irregular to subpinnate	*3. falcatum.*

1. CRATONEURON FILICINUM (L., Hedw.) Roth, l. c.

Hypnum filicinum L. Spec. Pl. 1125. 1753 and Hedw. Sp. Musc. 286. 1801.
Amblystegium filicinum De Not. Cronaca **2**: 25. 1867.

Very variable in habit and size, typically rigid, ascending to suberect and regularly pinnately branched, but occurring in stout or slender irregularly branched forms, bright to dark green above, brownish below, usually densely radiculose, reaching 10 cm. in length, *paraphyllia numerous, oval, laciniate, and branched:* stem leaves cordate-triangular, 1–1.4 mm. long, 0.6–0.8 mm. wide, *slenderly acuminate, open-erect to slightly falcate-secund;* branch leaves narrower and more falcate-secund; all rigid, little changed in drying, scarcely plicate, with margins plane or nearly so, finely serrate; *costa usually percurrent* but sometimes passing beyond the apex or sometimes not reaching it; leaf cells variable, elongated-hexagonal to oblong-linear, 6–9 μ broad and 3–6: 1, usually obtuse at the ends, gradually becoming wider towards the *base of leaf, there suddenly inflated, hyaline or colored, forming clearly defined decurrent auricles.* Sporophyte as in the generic description; spores in spring.

Type locality European.

ILLUSTRATIONS.—Bry. Eur. *pl. 609;* M. H. M. *pl. 75.*
EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 317, (Ed. 2) 469.
Aust. Musc. Appal. 413; Grout, N. Am. Musc. Pl. 215, 215a, 177 & 266 as *Amblystegium varium;* 242 as *Hypnum fluitans* var.

Some specimens, apparently growing in dry situations, have the auricles less inflated and more deeply colored. Slender forms of *Thuidium paludosum* may be mistaken for this species, but its more plicate leaves with recurved margins, and the abundant filamentose paraphyllia easily distinguish it. Frequent across northern N. America, south to Alabama and New Mexico, common in many localities in rivulets and springs, preferring those containing lime. While the variations in size, habit and appearance are great,

*An unusual condition in plants having a strong costa. Such a condition also obtains in *Drepanocladus revolvens.*

the decurrent auricles of inflated and usually clear cells form an earmark that makes recognition easy. There are forms in which the alar cells are less numerous, less inflated and more deeply colored. These culminate in

Var. ACICULINUM C. M. & Kindb. Cat. Can. Pl. **6**: 231. 1892, in which this area of cells is much reduced and colored, with thicker cell walls; costa excurrent into a rather slender point in both stem and branch leaves on most parts of the plants.

Forma *marianopolitanum* of *Hygrohypnum irriguum* approaches this variety so closely, even in the matter of inflated alar cells, that the two can scarcely be distinguished except by the fact that the branch leaves of forma *marianopolitanum* are nearly normal for *irriguum*, while those of variety *aciculinum* are mostly slender pointed with the excurrent costa.

My N. Am. Musc. Pl. 495 illustrates this variety, 291 is also a form of this variety closely approaching *H. irriguum marianopolitanum*. Musci Perfecti 177 is this variety and has the costa even stronger and more excurrent than in the type. A specimen of *Amblystegium fallax* (Brid.) Milde from Renauld and another from Mr. H. N. Dixon differ from var. *aciculinum* in having the costa as thick and strong as in *Hygroamblystegium irriguum spinifolium* but these also are evidently derived from *C. filicinum*. Specimens bearing the same name from the exsiccati of Husnot and Cardot seem to be *H. irriguum spinifolium*. I have yet to see true *fallax* from this continent.

2. CRATONEURON COMMUTATUM (Hedw.) Roth, l. c.

Hypnum commutatum Hedw. Musc. Frond. **4**: 68, *pl. 26*. 1797 and Sp. Musc. 284. 1801.
Hypnum glaucum Lam. Fl. Fr. **1**: 552. 1778.
Amblystegium glaucum Lindb. Musc. Scand. 32. 1879.

Plants in rather thick mats, *bright to yellowish green, ochraceous within and often incrusted with lime;* stems 4–10 cm. long, erect in thick tufts, ascending in the thinner mats, covered *with a dense growth of reddish brown radicles and linear to lanceolate paraphyllia, typically with regularly complanate and pinnate branching* but in American forms variable in size and manner of branching; *stem leaves decurrent, broadly cordate-triangular, rapidly narrowed to a long tapering channelled acumination, falcate-secund to circinate,* flexuose and more or less crispate when dry, *deeply plicate with margins plane and denticulate below,* and sometimes also toward the upper part, 1.5–2 mm. long; costa strong, ending in the acumination; median leaf cells oblong-linear to linear-flexuose, 35–80 μ long, 5–6 μ wide; cells broader and shorter at leaf base, subhexagonal, more or less inflated and colored or hyaline, *forming decurrent auricles at the basal angles;* branch leaves ovate-lanceolate, smaller and narrower; cells of some of the small branch leaves much shorter and broader.

Dioicous; seta 4–5 cm. long, reddish-brown; capsule cylindric-arcuate, cernuous, chestnut to orange-brown, 3.5–4.5 mm. long, narrowed under the mouth when dry and empty; annulus present; operculum conic. Spores in spring; rarely produced. Type locality European.

ILLUSTRATIONS.—Bry. Eur. *pl. 607;* M. H. M. 317; *Pl. 17 I.*
EXSICCATI.—Aust. Musc. Appal. Suppl. 543; Grout, N. Am. Musc. Pl. Suppl. 1; R. & C. Musc. Am. Sept. Exsic. 339.

This species often resembles *C. filicinum*, from which it may be distinguished by its plicate leaves more flexuose when dry, narrower leaf cells, and smaller area of less abruptly differentiated alar cells. From all forms of *Drepanocladus* it is readily distinguished by the profusion of radicles and paraphyllia.

Infrequent and local in the mountainous districts of the northern U. S. and Canada. Markedly calcicolous. Willoughby, Vt.; Watkins Glen, N. Y.; Newfoundland; Colorado; Wyoming. This species and its close relative, *C. falcatum*, seem frequent in the Rocky Mountains of British Columbia.

Var. SULCATUM (Schimp.) Broth. Engler & Prantl, Musci (Ed. 2) 2: 334. 1925.

Hypnum sulcatum Schimp. Syn. 699. 1860.

Plants extremely slender with few radicles; stem leaves smaller, about 1 mm. long, regularly falcate-secund, widely ovate and suddenly acuminate, or ovate-lanceolate; costa weaker than in typical form, usually reaching about ½ the length of the leaf; leaf cells shorter and broader, 4–6: 1. *Pl. 17 K.*

Doubtfully found in N. America. Waghorne's specimens from Newfoundland so labeled are a mixed lot and none which I have been able to see are this form; Berggren's Greenland specimens have not been available.

A rare alpine form found in Great Britain only on Ben Lawers and Craig Chailleach "on wet alpine rocks."
Hypnum sulcatum var. *stenodictyon* Ren. Proc. Wash. Acad. Sci. 4: 341. 1902.

I have seen the type collection of this form. It is merely a slender form of *C. falcatum*. It has neither the short costa nor the broader leaf cells of var. *sulcatum*.

Var irrigatum (Zett.) Broth. see MF III

3. CRATONEURON FALCATUM (Brid.) Roth, Europ. Laubm. 534. 1905.

Hypnum falcatum Brid. Musc. Recent. 3: 63. *pl. 1. f. 6.* 1801.

Generally regarded as a subspecies of *C. commutatum.* Stems reaching 10 cm. in length, rarely with any noticeable regularity of branching in N. American forms; typically darker-colored than in *C. commutatum;* radicles much fewer; leaves more crowded, longer and more regularly and strongly falcate-secund, hardly flexuose when dry, relatively more slender, not cordate or triangular at base, broadly to narrowly oblong-lanceolate, less decurrent; costa very strong; median leaf cells longer, linear flexuose, typically with thicker walls. Spores in summer. Type locality European.

ILLUSTRATIONS.—Bry. Eur. *pl. 608, f.* β; Braithw. Brit. Moss Fl. *pl. 91; Pl. 17J.*
EXSICCATI.—Grout, N. Am. Musc. Pl. Suppl. 12.
Apparently with the range of *C. commutatum* and rather more abundant in the Rocky Mts.; Willoughby, Vt.; Owen Sound, Ontario; Idaho; Newfoundland; Alaska.
On the sides of Ben Lawers in Perthshire, Scotland, *C. commutatum* and *C. falcatum* were growing side by side without showing any very apparent intergrading, which leads me to believe that *falcatum* is better than a variety of *commutatum.*
A very slender form from Middle Arm, Newfoundland, Oct. 29, 1898, labeled as *Hypnum subsulcatum* Schimp., is very close to var. *gracilescens* Schimp., which differs from the type mainly in its reduced size throughout.

Hypnum falcatum var. *microphyllum* Kindb. Cat. Can. Pl. **6**: 232. 1892 is a variety of *Drepanocladus Sendtneri.*

4. CRATONEURON DECIPIENS (De Not.) Loeske, Moosfl. d. Harz, 311. 1903.

Thuidium decipiens De Not. Epil. Bry. Ital. 233. 1869.

Plants with the appearance of a slender form of *C. commutatum,* from which it differs as follows: stem leaves very broadly deltoid, often broader than long, suddenly contracted to the insertion, rather slenderly acuminate; median leaf cells elliptic-hexagonal, 7–8 μ wide, 4–5: 1; cells of all leaves markedly papillose, especially toward the base.

ILLUSTRATIONS.—Braithw. Brit. Moss Fl. *pl. 91;* Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *Pl. 58H; Pl. 17H.*
Frequent in Europe but doubtfully occurring in N. America, as all the available material has proved to be something else.

5. CRATONEURON PAPILLOSUM **n. sp.**

Plants in deep loose masses, *yellowish green;* stems slender ± 7 cm. in length, *subpinnately branching, with branches short or lacking on the lower part of the stem and clustered above,* unequal in length; *paraphyllia numerous, slender, filiform from a narrow base, often subserrulate on the margins; radicles abundant on stem and base of leaves;* leaves falcate, more or less secund especially at tips of stems and branches; *stem leaves elongated triangular-ovate,* about 2 x 0.75 mm., *plicate,* channelled at apex, somewhat flexuose; *finely and sharply denticulate at base* and more or less serrulate all around; *costa strong,* extending into apex; *leaf cells, especially those near the leaf base, papillose on both sides with low papillae from the cell angles;* median cells 5–6 x 45 μ; basal cells much as in *C. commutatum;* branch leaves smaller, narrower, more crispate and only slightly papillose. Sporophyte unknown.
Type from Columbia Falls, Montana, Oct. 10, 1895, R. S. Willaims no. 411. Type in herb. N. Y. Bot. Garden. Cotypes in herb. R. S. Williams & herb. A. J. G.

ILLUSTRATIONS.—*Pl. 17A, f. 5–9.*
Verdoon's Bryoph. Ard. Exs. 26 as *C. commutatum* var. *Janzenii* Loeske is a form of this species, a form regularly and evenly pinnately branched, with papillae rather less numerous than in the type. I collected a plant on Ben Lawers in Scotland in 1930 that, although referred to *commutatum,* has its leaves evidently papillose and is much nearer this species than *decipiens.* The European plants are dark to brownish green.
This species appears like very slender *commutatum* but the papillose leaves are less secund. It differs from *C. decipiens* in its leaves nearly three times as long as broad and in its much narrower and longer leaf cells.

6. CAMPYLIUM (Sull.) Mitt. Journ. Linn. Soc. **12**: 631. 1869.

Hypnum. subgenus *Campylium* Sull. Mosses U. S. 77. 1856.

Plants slender, rarely robust, growing in moist places, frequently in or near water, usually over earth or stones (except *C. hispidulum*). This genus is closely allied to *Amblystegium,* from which it differs in the longer, oblong to linear leaf cells, and typically squarrose to squarrose-recurved leaves (except *C. polygamum*

and *C. radicale*) with acumination usually channelled. Branching usually irregular. Central strand of few cells. Paraphyllia rarely present. The leaves are rarely secund, almost never falcate-secund, never circinnate, broadly ovate to lanceolate, plane-margined (except *C. Halleri*) and entire or serrulate, usually long-acuminate and decurrent; alar cells somewhat differentiated, quadrate to hyaline-inflated. Costa single in some species, in others short and double or lacking, never percurrent or excurrent. Usually dioicous. Capsules inclined to horizontal, curved and usually contracted under the mouth when dry and empty; annulus present; peristome of the perfect hypnaceous type. Type species, *C. hispidulum.*

KEY.

1.	Leaves with a well developed single costa	2.
	Leaves with costa short, double or wanting	5.
2.	Leaves not squarrose, sometimes widely spreading	3.
	Leaves markedly squarrose	4.
3.	Stem leaves cordate-ovate, abruptly and slenderly acuminate	*9. radicale.*
	Stem leaves broadly lanceolate, gradually narrowed to a very long and slender acumination	*8. polygamum.*
4.	Leaves ovate-lanceolate, abruptly narrowed to the long slender acumination; costa simple, reaching the middle of the leaf or beyond	*7. chrysophyllum.*
	Leaves broadly ovate, abruptly narrowed to a much shorter recurved acumination; costa shorter and usually forking	*5. Cardoti.* W
5.	Plants slender; alar cells not conspicuously enlarged or inflated (except *C. Treleasei*); paraphyllia few (except varieties of *C. Halleri*); monoicous	9.
	Plants more robust; alar cells usually conspicuously enlarged or inflated; paraphyllia none; dioicous	6.
6.	Leaves gradually long-acuminate	*3. stellatum.*
	Leaves abruptly acuminate from a broadly ovate to cordate-ovate base	7.
7.	Costa often reaching the middle	*5. Cardoti.* W
	Costa seldom reaching even ⅓ length of leaf	8.
8.	Leaves short-acuminate	*6. arcticum.* NW
	Leaves long and slenderly acuminate	*3. stellatum* var. *protensum.*
9.	Leaves squarrose	10.
	Leaves subimbricate, sometimes somewhat secund	*4. Treleasei.* NW
10.	Leaves strongly squarrose-recurved, most strongly serrate at apex	*2. Halleri.* W
	Leaves squarrose, moderately or not at all recurved, most strongly serrate at base	*1. hispidulum.*

Leptodictyum trichopodium Kochii and *Amblystegium Juratzkanum* may be sought in this genus as they have spreading leaves, but their leaves are spreading from the base and not bent, consequently they will lie flat on the slide when mounted while the species of *Campyllium* likely to be confused with them will not. *Plagiothecium striatellum* has the appearance of this genus because of its squarrose leaves, but the leaves are markedly serrate, ecostate; stem without central strand and capsules strongly striate when dry.

1. CAMPYLIUM HISPIDULUM (Brid.) Mitt. Journ. Linn. Soc. **12**: 631. 1869.

Hypnum hispidulum Brid. Spec. Musc. **2**: 198. 1812.

Plants slender, interlaced in bright green tufts; stems creeping, irregularly branching; stem leaves reaching 0.8 mm. long, widely spreading *to squarrose, triangular-cordate, rather abruptly narrowed to an acumination which varies in length from 1 to 1.5 times the length of the body of the leaf*, somewhat concave, *subserrulate all around, more strongly so at base, decurrent, excavate; costa nearly or quite lacking;* median leaf cells *about 6 μ wide, 3–6 : 1;* basal cells shorter; *differentiated alar cells numerous, subrectangular to quadrate*, 9–12 μ in width; branch leaves similar, less broadly ovate and less abruptly acuminate; perichaetial leaves oblong-lanceolate, sheathing, reaching 1.5 mm. in length. Monoicous; seta 1.5–2.5 cm. long, chestnut to yellowish; capsule small, oblong, more or less curved and cernuous, yellowish brown, often darker with age; operculum conic-apiculate; annulus simple; peristome perfect. Spores in late spring.

Type locality, Pennsylvania.

On bases and roots of trees, decaying wood and humus on or near the ground in moist shaded places. Common in northeastern U. S. and eastern Canada, especially in cool elevated regions; south to N. Carolina,

Alabama, Missouri, and Texas; west to Idaho and British Columbia. The leaves vary greatly in the width of the basal part and in length and slenderness of acumination. The narrow-leaved forms culminate in var. *Sommerfeltii* and the broad-leaved forms in var. *cordata*.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 199;* Jennings, Mosses W. Pa. *pl. 41;* M. H. M. 322.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 341; Sull. Musc. Allegh. 37; Aust. Musc. App. 392; Grout, N. Am. Musc. Pl. 185; R. & C. Musc. Am. Sept. Exsic. 331.

Var. SOMMERFELTII (Myr.) Lindb. Contr. ad Fl. Crypt. As. Bor. 279. 1872.

Hypnum Sommerfeltii Myr. Vet. Akad. Årsb., Stockholm, **1831:** 328.

Very slender; stem leaves more narrowly cordate-ovate at base; acumination very long and slender, reaching twice the length of the body of the leaf; leaf cells typically rather longer, differentiated alar cells fewer in number, sometimes colored; paraphyllia occasional as in the species. *Pl. 17 A.f. 2.* Dixon says "On calcareous soil principally."

Specimens collected by Miss Leonard near Boulder, Colorado are practically identical with the European form which is the type of this variety; Oklahoma, comm. Conard.

EXSICCATI.—Aust. Musc. App. 393 from the White Mts. is near this variety; Michigan; New Brunswick to British Columbia in Canada. See Macoun, Cat. Can. Pl. **6:** 223.

Var. CORDATUM **n. var.** Plants stouter, *branches short, erect and crowded like coarse velvet pile;* leaves crowded and almost sheathing, *almost exactly cordate,* 0.6 by 0.72 mm., *more strongly serrulate; abruptly and more shortly acuminate; acumination squarrose-spreading; body part of leaf often broader than long; paraphyllia more abundant, larger, multiform,* often *almost laciniate with long projecting cells;* median cells shorter, 6 μ wide; *quadrate and rectangular alar cells much more numerous, extending almost to costa at base and up the margin to the widest part of the leaf;* traces of a very short, rather wide costa present in most leaves. Capsules small, 1.5 mm. long. Type from Moore's Spring, near Winston-Salem, N. Carolina, on decaying stumps, P. O. Schallert. Type in herb. A. J. G. *Pl. 17A. f. 1.*

This is the culmination in variation of the "forma *compacta*"* described on p. 323 of M. H. M. "Apparently growing in drier places, it has its leaves closer together and branch leaves shorter-acuminate and more strongly serrulate and leaf cells shorter than figured by Sullivant." This form is not uncommon but the type of var. *cordatum* is unlike anything else I have seen. If the latter turns out to be a constantly recurring form it should be raised to specific rank as CAMPYLIUM CORDATUM. Its capsules were operculate in August but have an undeveloped appearance and there was evidence that the sporophytes were infested with a fungus, but the plants as to stems and leaves seemed unusually healthy and vigorous.

2. CAMPYLIUM HALLERI (Sw., Hedw.) Lindb. Musc. Scand. 38. 1879.

Hypnum Halleri Sw. Meth. Musc. 34. 1781 and Hedw. Sp. Musc. 279. 1801.
Hypnum Macounii Kindb., Macoun Cat. Can. Pl. **6:** 224. 1892.
Campylophyllum Halleri Fleisch. Hedwigia **47:** 195. 1907.

Plants intertangled in dense but thin mats, bright green to brownish; stems rather irregularly or subpinnately branching, prostrate; *leaves crowded, squarrose-recurved;* stem leaves reaching 1 mm. in length, *ovate to deltoid-ovate, narrowed more gradually to the shorter acumination than in the last,* concave, narrowed to the insertion, slightly decurrent, not excavate; *margins entire and slightly recurved below, plane and serrulate above;* median leaf cells oblong-linear, 30-40 x 5 μ; area of quadrate to oblong alar cells small; *costa entirely lacking in most cases;* branch leaves smaller and narrower. Autoicous; capsules small, about as in *C. hispidulum,* oblong-cylindric, curved and cernuous; annulus simple.

Type locality European. On earth and rocks; British Columbia, Newfoundland, Montana. Rare; occasional in the Rocky Mountain region. Most American plants differ from most European *Halleri* in having the leaves less crowded, more decurrent and less strongly recurved, with more numerous and clear quadrate alar cells. The leaves are also more narrowed to the insertion with lower margin nearly entire. In nearly all of these particulars they are closely approached by specimens collected on Ben Lawers in Scotland.

After a study of these forms it seems a needless and unwarranted multiplication of genera to make a separate genus for *C. Halleri.*

ILLUSTRATIONS.—Bry. Eur. *pl. 581; Pl. 18.*

EXSICCATI.—Drumm. Musc. Am. 191; R. & C. Musc. Am. Sept. Exsic. 332.

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* *Hypnum byssirameum* C. M. & K. is this form. The type in the Kindberg Herbarium has been examined.

3. Campylium stellatum (Schreb., Hedw.) Lang. & C. Jens. Consp. Fl. Groenl. 328. 1887.

Hypnum stellatum Schreb. Spic. Flor. Lips. 92. 1771, and Hedw. Sp. Musc. 280. 1801.

Plants the most robust of the genus, bright to yellowish golden-green, in rather thick tufts or mats; stems stout, irregularly branching, erect to ascending, 5–10 cm. long; leaves 1.5–3 mm. long from *a widely ovate or triangular-cordate base, gradually or rather abruptly narrowed to a long tapering channelled acumination, spreading to squarrose,* usually entire at base, somewhat excavate with rounded scarcely decurrent auricles; *costa lacking or occasionally present* and thin or forking; median leaf cells ± 45–75 x 6 μ, narrowly linear, becoming thicker-walled and porose in older leaves; *alar cells subrectangular, enlarged, pellucid or colored, conspicuous.* Dioicous; seta 2–3.5 cm. long; capsule brown to chestnut, oblong-cylindric, curved and cernuous, ± 3 x 1 mm., usually contracted under the mouth when dry and empty. Spores in *spring.* All the authorities say summer, but in the specimens I have examined all capsules collected after June 1st were deoperculate. Capsules are sparingly produced and most collections are sterile.

Illustrations.—Bry. Eur. *pl. 584;* Jennings, Mosses W. Pa. *pl. 42;* M. H. M. *pl. 77.*

Exsiccati.—Drumm. Musc. Am. 184; Sull. Musc. Allegh. 35; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 339, (Ed. 2) 515; Aust. Musc. Appal. 399; Grout, N. Am. Musc. Pl. 290 & 373; R. & C. Musc. Am. Sept. Exsic. 334.

While apparently preferring cool bogs, this has been collected at Hyannis, Mass. in a marsh opening into salt water. Northern U. S. and Canada; ranging west to the Rocky Mts., Colorado, British Columbia and Alaska; south to Pennsylvania and Ohio in the East.

Not abundant but widely distributed.

Var. protensum (Brid.) Roehl. (M. H. M. 327).

Hypnum protensum Brid. Musc. Rec. 2^2: 85. *pl. 2. f. 3.* 1801.

Plants slender, more elongate and prostrate; leaves more distant, smaller, more abruptly narrowed from a distinctly cordate-ovate base to a longer and more slender acumination. *Pl. 17A. f. 3.*

Exsiccati.—Grout, N. Am. Musc. Pl. 352.

Apparently with the range of the species but much less frequent. North American forms are best treated as a variety of *stellatum.* This variety bears about the same relation to *stellatum* that var. *Sommerfeltii* bears to *C. hispidulum.*

European authors seem agreed that *C. stellatum* and *C. chrysophyllum* are very close to each other and have intermediate forms. This does not seem true in N. American plants.

*4. Campylium Releasei (Ren.) Broth. Engler & Prantl, Musci (Ed. 1) 1043. 1909.

Hypnum Releasei Ren. Proc. Wash. Acad. Sci. **2**: 338. *pl. 22, fig. 5a–e.* 1900.

Densely cespitose, fragile, yellowish green; stems short, 2–3 cm. long, erect, radiculose below; branches fastigiate, erect, *outer layer of cells of stem and branches large and hyaline;* leaves close together, *subimbricate,* sometimes slightly secund, small, 1.2 x 0.6 mm., ovate-lanceolate, *rather shortly acuminate, usually minutely denticulate,* concave, not plicate, subclasping and narrowly decurrent at base; costa short and double or wanting; *median leaf cells 30–40 μ,* rarely 60 μ long, 6-7 μ wide, growing broader and shorter toward the base; *at basal angles a group of dense, subquadrate cells* and below these a number of hyaline inflated cells (not well shown in illustration) form small decurrent auricles. Sporophyte unknown.

Type from St. Matthews Island, Alaska. Trelease 2158 and 2865.

Cotype seen at the N. Y. Botanical Garden and also another from the Missouri Botanical Garden.

A form from Virgin Bay, Juneau, Alaska, has longer more slenderly acuminate leaves with longer and narrower cells.

This is clearly a subspecies of *C. stellatum,* distinguished by its smaller size and the characters italicised in its description.

The description and drawings are based on the St. Matthews specimens. *Pl. 18. fig. 5a–e.*

*5. Campylium Cardoti (Thér.) Broth. Engler & Prantl, Musci (Ed. 1) **2**: 1043. 1909.

Hypnum Cardoti Thér. Bot. Gaz. **30**: 125. *pl. 11, f. 4.* 1900.

Plants olive-green, soft, lax, depressed-cespitose; stems creeping or ascending, 2-4 cm. long, irregularly branching; leaves rather distant, squarrose-spreading, sometimes subsecund, broadly deltoid-ovate, narrowed at base and decurrent, above rapidly narrowed to a *rather short narrow recurved acumination,* about 1.5 x 0.75 mm.; margins plane, *sinuate-dentate* nearly the whole length; *costa single and forking,* reaching the middle of the leaf or shorter and double; median leaf cells linear, subflexuose; basal shorter

and broader; alar lax, larger, subhyaline; outer perichaetial leaves ovate-lanceolate, shorter-acuminate, subentire, ecostate; the inner plicate and costate. Polygamous; seta reddish; capsule about 1.8 cm. long, oblong, arcuate and subhorizontal; operculum convex-apiculate. (Translated from the original description.) "This species should be considered a subspecies of *stellatum*" from which it is distinguished by the polygamous inflorescence and the softer leaves with a shorter acumination and the "looser areolation."

Avalanche Basin, northern Montana, Holzinger. *Pl. 18. figs. 4a–d.*

6. Campylium arcticum (Williams) Broth. Engler & Prantl, Musci (Ed. 2) **2**: 336. 1925.

Chrysohypnum arcticum Williams, Rep. Can. Arctic Expd. **4**: 10e. *pl. 15e, figs. 13–18.* 1921.

Stems short, 1–2 cm., pale yellowish, without radicles and with few irregular branches; central strand small and two outer layers of stem cells usually with thickened walls; stem leaves appressed at base, broadly ovate, subclasping, *very concave, not decurrent,* reaching 1.7–2 x 1.4 mm., *suddenly contracted into an acute widely spreading acumination;* margins entire, and plane or incurved below; costa mostly short and double, or rarely single and usually slightly forking above, rarely extending up ⅓ the leaf; branch leaves narrower, very concave, mostly ecostate or with very short costa; median leaf cells pale, thin-walled, 25–40 x 7–8 μ; basal cells often with somewhat thickened and golden brown walls, *broader and shorter than those above and extending to the costa, the alar rarely forming a rather distinct, somewhat inflated cluster.* Sterile, no archegonia or antheridia found.

(Adapted from the original description.)

"Type locality, swamp on Pihumalerksiak Island off Cockburn Point, Dolphin and Union Strait, Northwest Territories, July 15, 1916, F. Johansen." Type seen, a very distinct species.

"This species seems to come nearest to *C. stellatum* but the leaves are relatively much broader below" and much more shortly acuminate, "the cells about twice as broad in proportion to their length, with the cell walls thinner throughout and not pitted." *Pl. 18. figs. 13–18.*

7. Campylium chrysophyllum (Brid.) Bryhn, Expl. 61. 1893.

Hypnum chrysophyllum Brid. Musc. Rec. **2**[2]: 84. *pl. 2, f. 2.* 1801.
Hypnum polymorphum Hook. & Tayl. Musc. Brit. 107. 1818.
Hypnum unicostatum C. M. & Kindb. Macoun Cat. Can. Pl. **6**: 224. 1892.
Hypnum sinuolatum Kindb. Hedwigia, **1897**: 47 (Type seen).
Hypnum subsecundum Kindb. Rev. Bryol. **22**: 87. 1895 (Type seen).

Plants slender, creeping, irregularly and diffusely to subpinnately branching, forming thin loose mats in some cases, in others cespitose; leaves squarrose-spreading from a somewhat clasping base, occasionally somewhat secund in varietal forms; stem leaves ovate to ovate-lanceolate, decurrent, rather abruptly narrowed to a long slender, somewhat channelled acumination, ± 1.5 x 4.5 mm., typically entire or slightly denticulate at base; branch leaves narrower, lanceolate to ovate-lanceolate; costa single, reaching the middle of the leaf or beyond; leaf cells 5–9 μ wide, 4–6 : 1; a small group of alar cells shorter and subquadrate. Dioicous; capsule oblong-cylindric, curved and cernuous, reaching 3.5 mm. in length, contracted under the mouth when dry and empty; operculum conic-apiculate; annulus present, of more than one row of cells; peristome perfect. Spores in spring to early summer.

Illustrations.—Bry. Eur. *pl. 583;* Jennings, Mosses W. Pa. *pl. 41;* M. H. M. 323.

Exsiccati.—Drumm. Musc. Am. 185, 186; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 340, (Ed. 2) 516; Sull. Musc. Allegh. 36; Aust. Musc. Appal. 397, 398; Grout, N. Am. Musc. Pl. 314, 320 & 334; R. & C. Musc. Am. Sept. Exsic. 333. Austin's 398 has strongly secund leaves and was called by him "*var. uncinifolium.*"

Common in northeastern N. America; south to Georgia and Texas, west to New Mexico, Arizona, Minnesota and British Columbia. Growing over earth, stones and humus in moist places. It varies greatly in robustness and density of tufts, length of costa, length and slenderness of acumination, spreading of leaves, serrulation of margin and size of capsule.

We have forms of *chrysophyllum* with the costa short in some of the leaves and forms of *stellatum* that have a costa reaching nearly to the middle of the leaves but these are infrequent. In these intermediate plants the costa often varies greatly in the leaves of the same plant.

We have forms of *chrysophyllum* that are practically identical with the European plant, yet by far the greater number of plants that I have examined have branch leaves with a broader and rather shorter acumination, which is sinuate to subserrulate, having leaf cells rather broader in proportion to their length. The

very young leaves are often serrate at apex. These forms culminate in var. *brevifolium* and I have named them f. INTERMEDIUM Grout, M. H. M. 324.

Hypnum unicostatum C. M. & K. of Macoun's Can. Musci 840, 132 of my N. Am. Musc. Pl. and Austin's Musc. Appal. 394 and 395 are this form.

Var. BREVIFOLIUM (R. & C.) Grout, M. H. M. 324. 1910 (var. *carolinianum* Grout, Bryol. **11**: 29. 1908).

Hypnum chrysophyllum brevifolium R. & C. Bull. Herb. Boiss. **4**: 19. 1896.

Very robust; leaves often more or less falcate, somewhat secund in the type, more gradually and less slenderly acuminate, many plainly serrulate at apex. N. Am. Musc. Pl. 313. Apparently more frequent southwards.

The type of *Hypnum subsecundum* Kindb., from Newfoundland, Waghorne, is a form of *chrysophyllum* having the upper leaves secund and somewhat falcate, more erect than in the typical form; basal and alar colored, the median rather narrower. All the specimens in Kindberg's herbarium that were not cited with the original description were forms of *chrysophyllum* having upper leaves secund. (One exception was a depauperate *Drepanocladus uncinatus*.) The Credit Forks, Ontario, specimen cited by Macoun was ordinary *chrysophyllum* with upper leaves a little secund.

Var. ZEMLIAE Jens.

Campylium zemliae Jens. Meddel om Groenl. **3**: 322. 1887.
Chrysohypnum polygamum zemliae (Jens.) Moenkem. Laubm. Eur. 718. 1927.

Pale yellowish-brown, a few centimeters in length, ± erect, irregularly branching; leaves narrowly acuminate from a cordate base, entire, acute, spreading or the branch leaves somewhat secund; costa reaching the middle of the leaf or longer, or shorter and forked; leaf cells in the lower half short and broad, subrectangular; upper leaf cells longer and narrower; alar larger, rectangular, hyaline or brownish-yellow. Greenland, also Spitzbergen, Nova Zembla.

Cotype seen through the courtesy of Dr. C. Jensen. The specimen was from Nova Zembla, Aug. 1882, collected by Th. Holm. It seems to the writer to be undoubtedly a form of *C. chrysophyllum* having its leaves rather more slender than usual, 0.35 × 1.3 mm.

8. CAMPYLIUM POLYGAMUM (Br. & Sch.) Bryhn, Expl. 61. 1893.

Amblystegium polygamum Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 572.* 1853.
Hypnum polygamum Sch. Syn. 604. 1860.

Plants loosely to densely cespitose, yellowish to dark or golden green; stems creeping to ascending, 2–8 cm. long, irregularly branching; stem leaves erect-spreading, not squarrose, not crowded, entire, broadly lanceolate, occasionally ovate-lanceolate, 2–2.5 x 0.8 mm., gradually and evenly tapering to a long channelled acumination, rounded at the clasping base; costa single, variable but usually reaching at least ½ the length of the leaf, distinct but not strong; median leaf cells narrowly linear and somewhat flexuose, thin-walled except when old, ± 7 μ wide and 8–12 : 1 (Limpricht says 10–15 : 1); branch leaves similar but smaller; enlarged basal cells reaching nearly to the costa; the alar inflated and often colored, forming distinct auricles; inner perichaetial leaves reaching 4 mm. in length, entire, plicate, costa ending before the apex. Polygamous; seta 2–4 cm. long, reddish brown; capsule with a short erect neck, oblong-cylindric, curved and cernuous, brown, turning chestnut with age, ± 2.5 × 0.8 mm.; operculum conic-apiculate; annulus present; peristome perfect. Spores spring to early summer.

ILLUSTRATIONS.—Bry. Eur. l. c.; Jennings, Mosses W. Pa. *pl. 42;* M. H. M. 326.
EXSICCATI.—Aust. Musc. Appal. 401; Grout N. Am. Musc. pl. 430.

Swamps and wet meadows, northern U. S. to arctic N. America, south to New Jersey, Pennsylvania and Virginia. The costa is frequently short and double in some leaves and well developed on others of the same plant. Occasional forms are found with some of the leaves broadly ovate at base with almost the outline of forms of *C. stellatum*, which it approaches on one hand in its larger forms with somewhat variable costa. On the other hand in its smaller forms with more spreading leaves it approaches *C. chrysophyllum*, but is easily distinguished by the inflated alar cells. These smaller forms culminate in a form close to the European var. *minus*.

Var. MINUS (Sch.) **n. comb.**

Hypnum polygamum var. *minus* Sch. Syn. (Ed. 1) 604. 1860.

Plants about the size and appearance of *C. radicale* but distinguished by the longer and narrower leaf

cells and the less abruptly acuminate leaves. This form seems frequent in Florida and probably is the southern representative of the species.

Exsiccati.—Grout, N. Am. Musc. Pl. 371, 275 issued as *C. chrysophyllum* and reported later as *C. radicale*. Dr. Best in naming 371 said, "Approaching var. *minus* (Sch.). var. *minus* seems scarcely distinguishable from *Amblystegium hygrophilum* (Jur.). The leaf cells are, however, longer narrower and more flexuose." After a great deal of hesitation I have decided to accept Dr. Best's point of view. This variety is about ½ the size of the typical form and has more widely spreading leaves. It is really a connecting link between *C. polygamum* and *C. radicale* and seems to me to show clearly that the affinities of the latter are with *Campylium* rather than *Amblystegium*.

Var. longinerve (R. & C.) Grout **n. comb.**

Hypnum polygamum longinerve R. & C. Bot. Centralbl. **44:** 423. 1890.
Campylium polygamum longinerve (R. & C.) Grout N. Am. Musc. Pl. List, nos. 1–400. 1912.

Plants with the appearance of a large form of *C. polygamum* but with terminal leaves occasionally somewhat secund; leaves very long and narrow, stem leaves reaching more than 3 mm. in length and less than 0.6 mm. wide with slender apex more deeply channelled than in typical forms; alar cells less conspicuously enlarged and differentiated cells fewer in number, scarcely forming auricles; leaf cells longer and narrower than is usual in *C. polygamum;* costa strong in all leaves, percurrent to excurrent into a slender filiform point; inner perichaetial leaves long-lanceolate with a wide excurrent costa, serrate above just below where the lamina ceases. Monoicous; seta ± 2 cm. long, red-brown; capsules about 3 mm. long, brown, cylindric-arcuate and cernuous; peristome perfect; spores in spring.

Type locality, Victoria, Vancouver Island.

Described from N. Am. Musc. Pl. 208 from Seattle, Washington, which was identified by Renauld himself.

Distinguished from *Drepanocladus aduncus capillifolius* by the strongly channelled apex and the less conspicuous alar cells. The Seattle plant is so near *D. aduncus capillifolius* that I incline to the view that this variety should rather be referred to that plant.

Var. fluitans **n. var.**

Plants floating, *yellow-green;* leaves *squarrose spreading,* somewhat shriveled in drying, broadly ovate-lanceolate with acumination shorter than in typical forms; costa 60 μ wide at base, often forking; walls of leaf cells thicker, about 2 μ; median leaf cells 7–8 x 25–45 μ. Type floating in ponds, Gray Eagle Valley, Plumas Co., California, Sept. 1900. Alt. 6500 ft. J. B. Leiberg, No. 5495. *Pl. 17A, f. 4.*

Type in herb. N. Y. Botanical Garden.

9. Campylium radicale (P. B.) Grout, Bryol. **12:** 96. 1909.

Hypnum radicale P. B. Prod. 68. 1805. Not *Amblystegium radicale* Br. & Sch.
Hypnum bergenense Aust. Musc. Appal. 391, 18. 1870.
Hypnum hygrophilum Jur. in Rabenh. Bryoth. Eur. no. 649. 1869.
Hypnum chrysophyllum var. *tenellum* L. & J. Man., not Br. & Sch.
Hypnum decursivulum C. M. & Kindb. Macoun, Cat. Can. Pl. **6:** 224. 1892. Type seen.

Plants slender, lax, little branched, in very thin network over decaying leaves, humus, etc.; stem leaves distant, not squarrose but widely spreading, nearly or quite entire, resembling those of *C. chrysophyllum* but with more enlarged alar cells, ± 0.7 x 1.3 mm., broadly cordate-ovate and somewhat decurrent, subclasping and excavate at base so that *the leaves will not lie flat when removed and mounted;* apex somewhat channelled; median leaf cells thin-walled, hexagonal-linear, ± 7.5 μ x 30–45 μ; alar cells rather abruptly enlarged, hyaline or nearly so; costa well developed, reaching the middle or beyond. Seta reddish brown ± 4 cm. long; capsules light brown, 2–2.5 mm. long, 3–4 : 1, cernuous and arcuate, contracted under the mouth when dry and empty. Spores in early spring.

Illustration.—M. H. M. 337.

Type locality, North America. Type in herb. Schwaegrichen. Probably frequent in the eastern U. S. and Canada, but not readily recognized; south to Florida.

Distinguished from all species of *Amblystegium* by the leaf bases as described above and the channelled acumination; from *C. chrysophyllum* in the lax habit of the little branched plants with distant, non-squarrose leaves and inflated alar cells.

Loeske, Hedwigia **51:** 286–298, disagrees with the contention that this plant is the same as *Hypnum*

hygrophilum Jur. He is correct in saying that the latter is monoicous, so also is *H. bergenense*, Aust. Musc. Appal. 391, as Austin plainly states on his label "(parasitico-monoica)."

The statement in my key M. H. M. 321, that *Campylium radicale* is dioicous is an error, the occurrence of which I cannot satisfactorily explain to myself.

Whatever may be the theoretically correct name of the plant, I am sure that no. 345 of the Bry. Silesica of Limpricht is practically identical with Austin's 391 and that both represent a species of frequent occurrence in eastern N. America, distinguishable from *C. chrysophyllum* as noted above and from *Leptodictyum trichopodium Kochii* (to which Loeske compares it) by the narrower leaf cells and the inflated alar cells, similar to those in *C. stellatum* but rather less conspicuous. Plants of this species collected near Montreal by Dupret have a rather faint costa not reaching to the middle of the leaf and alar cells less abruptly differentiated.

Loeske thinks *Hypnum hygrophilum* is polyphyletic. This may very well be, but one of its components at least seems to me to be clearly the same as Austin's *Hypnum bergenense* and probably, but less certainly the same as *Hypnum radicale* P. B.

Campylium pseudocomplexum (Kindb.) Broth. l. c.; *Hypnum pseudocomplexum* Kindb. l. c. 85.

"Leaves small, neither circinate nor distinctly recurved, not appressed when dry; inner basal cells yellow (at least on the stem leaves) and oblong, the angular suboval, small and not well defined; costa indistinct or short and double. Stem leaves ovate or ovate-oblong, short-acuminate and nearly straight. Branch leaves ovate-lanceolate, longer acuminate, often falcate. Tufts dense and pale green. Stem irregularly divided, not radiculose. Resembles a variety of *H. molluscum* in the habit. Capsules not found. Dioecious."

"America, Arctic district. Alaska: J. M. Macoun."

No plants of this species have been available. Not only the species but its systematic position is doubtful.

7. HYGROHYPNUM Lindb. Act. Soc. Fenn. **10**: 277. 1872.

(*Limnobium* of the Bry. Eur. and Mitten is antedated by a genus of flowering plants.)

Plants aquatic, *growing on stones and rocks in streams*, rarely in bogs or on wood; main stems procumbent with ascending branches, not radiculose, often defoliate below, irregularly and sparingly branched; central strand usually present; pseudoparaphyllia found only at the insertion of the branches; stem and branch leaves little different, often somewhat secund, *mostly short and broad*, usually soft, *obtuse and rounded*, sometimes apiculate or shortly pointed, rarely acuminate and acute, more or less decurrent, usually entire; *costa in most cases short and double*, or *longer and forked*, in a few species mostly single and reaching the middle of the leaf or beyond. The costa not infrequently occurs in all these different forms in the leaves of the same plant. Alar cells differentiated, more or less enlarged, *subrectangular and in some cases moderately inflated* and hyaline, *in most incrassate and colored*, often remaining attached to the stem when the leaves are removed. Capsule cernuous or horizontal, ovoid to subcylindric, unsymmetric or arcuate, usually contracted under the mouth when dry and empty; peristome perfect (*alpinum* has cilia rudimentary or lacking); annulus present; operculum mammillate to conic-apiculate.

This genus is nearest to *Drepanocladus*, from which it is distinguished by its habitat in running streams, and its relatively broader, concave and more obtuse leaves. *Scorpidium* is distinguished by its gigantic size and rugose leaves; *Calliergon* by its habitat and general appearance. *Sematophyllum marilandicum* bears a very close resemblance to this genus in habitat and in general appearance when sterile, but its alar cells are more inflated and hyaline and the costa is very short or wanting. Aquatic *Brachythecieae* have a similar habitat and appearance but are easily distinguished by the acutely acuminate leaves, strong single costa, and rough seta, except in the case of *Sclerodium* species, in which the leaves may be blunt with short apical cells. *S. obtusifolium* was at first put in this group as a subspecies of *Hypnum*. Slender forms of *S. apocladum* approach this genus closely, but when in fruit the rough seta is a certain distinction. *Eurhynchium rusciforme* is often sought here also. In this species the seta is smooth but the operculum is long-rostrate.

Type species *H. palustre*.

Our species may be arranged in the following groups:

I. *Palustriformes*. Leaves more than twice as long as broad, very concave with upper margins often infolded, entire or slightly serrulate above, alar cells various; includes *palustre*, *alpestre*, *polare*, *eugyrium*, *subeugyrium* and *styriacum*.

II. *Arctici*. Leaves less than twice as long as broad (except *closteri*), often nearly circular in outline, more or less concave, entire or slightly serrulate at apex; margins usually plane. Includes *Smithii*, *cochlearifolium*, *molle*, *dilatatum*, *alpinum*, *Bestii*, *closteri* and *norvegicum*.

III. *Montani*. Stems without central strand. Leaves ovate, acuminate to apiculate, distinctly serrulate to serrate above, slightly decurrent, lower margins reflexed; *montanum* and *novae-caesareae*.

IV. *Ochracei*. Outer layer if stem cells enlarged and hyaline forming a hyaline sheath, *ochraceum*.

KEY.

1. Outer layer of stem cells enlarged, thin-walled and hyaline, forming a conspicuous hyaline sheath ..... *1. ochraceum.*
   Outer stem cells not as above ..... 2.
2. Costa *usually* single, reaching the middle of the leaf or beyond ..... 3.
   Costa lacking, or short and double or forking ..... 9.
3. Leaves small, less than 1 mm. in length ..... 4.
   Stem leaves more than 1 mm. in length ..... 6.
4. Stem and leaves stiff and harsh to the touch; leaves widely spreading, nearly as broad as long ..... *8. Smithii.*
   Plants soft; leaves loosely suberect to falcate-secund, longer than broad ..... 5.
5. Leaves strongly concave; upper leaves falcate-secund ..... *3. pseudomontanum.*
   Leaves slightly concave to nearly plane, neither falcate nor secund ..... *11. closteri.*
6. Costa strong, rarely forking, reaching nearly or quite to the leaf apex ..... 7.
   Costa strong, single or forking, rarely reaching much beyond the middle of the leaf ..... 8.
7. Leaves broadly oblong-ovate, erect-spreading, only occasionally slightly secund at ends of stem and branches ..... *4. polare.*
   Leaves narrowly oblong-ovate to oblong-lanceolate, mostly secund, usually falcate, varieties of ..... *2. palustre.*
8. Stem leaves broadly obtuse to apiculate, concave, but with upper margins scarcely inrolled ..... *5. alpestre.*
   Stem leaves gradually acuminate, acute to narrowly obtuse; upper margins usually strongly inrolled ..... *2. palustre.*
9. Leaves broadly ovate to suborbicular ..... 10.
   Leaves lanceolate to broadly ovate-lanceolate ..... 14.
10. Leaves exceedingly concave, entire, less than 1 mm. long ..... *9. cochlearifolium.*
    Leaves slightly concave to nearly plane, often serrulate at apex, more than 1 mm. long ..... 11.
11. Plants stiff, harsh to the touch, leaves widely spreading, broadly ovate to suborbicular, often somewhat secund ..... 12.
    Plants soft, broadly ovate, not secund ..... 13.
12. Leaves very large, reaching 3 mm. in length ..... *14. Bestii.*
    Leaves rarely over 1.5 mm. in length ..... *13. dilatatum.*
13. Plants moderately robust; leaves reaching 1.5 mm. in length; widely distributed in the Northwest ..... *12. molle.*
    Plants slender; leaves ±0.7 mm. long; known in North America from Greenland only ..... *10. norvegicum.*
14. Leaves distinctly serrulate in the upper half at least ..... 15.
    Leaves entire or minutely denticulate at extreme apex ..... 16.
15. Leaves serrulate nearly or quite to base, more or less falcate secund; quadrate alar cells not appreciably inflated ..... *15. montanum.*
    Leaves serrulate in the upper half only, sometimes slightly secund but not falcate; alar cells somewhat inflated ..... *16. novae-caesareae.*
16. Extreme angular leaf cells somewhat inflated, hyaline or colored ..... *6. eugyrium.*
    Extreme angular cells only slightly or not at all inflated ..... 17.
17. Some leaf apices denticulate ..... *7. subeugyrium.*
    All leaf apices entire ..... *2. palustre.*

Hypnum malocladum Card. & Thér. Bot. Gaz. **37**: 380. *Pl. 25.* 1904, is omitted because of lack of data on the label. North America is too vague and too likely to be erroneous.

1. HYGROHYPNUM OCHRACEUM (Turn.) Loeske, Moosfl. d. Harz. 321. 1903.

Hypnum ochraceum Turn. mscr., Wils. Bryol. Brit. 400. 1855.

Plants in wide loose submerged mats, green, yellowish-green, or brown, often tinged with red; main stems prostrate or floating, reaching 9 cm. in length, irregularly branching, branches comparatively few,

procumbent to ascending, usually curved at the ends; central strand of few cells; *outer layer of stem cells conspicuously enlarged and hyaline;* leaves close, *usually strongly falcate-secund,* concave, entire except *at the minutely denticulate apex,* about 1.8 × 0.9 mm., *oblong-ovate to oblong-lanceolate, slightly rounded at base, gradually tapering to the longer or shorter blunt apex,* often somewhat contorted above; *costa variable, single or double,* often reaching the middle of the leaf or beyond; median leaf cells linear-flexuose, 5–6 μ wide, 8–15 : 1; apical much shorter; basal shorter and broader; *alar abruptly enlarged, inflated and hyaline, forming large conspicuous decurrent auricles.* Dioicous; capsule brown, oblong-ovoid, unsymmetric, 2–2.5 × 1 mm., cernuous to horizontal, contracted under the mouth when dry; operculum conic-apiculate; annulus of 3–4 rows of cells; peristome perfect. Spores in summer, infrequently produced. Type locality English.

ILLUSTRATIONS.—Br. & Sch. Bry. Eur. *pl. 580;* Jennings, Mosses W. Pa. *pl. 41;* M. H. M. *pl. 80.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 305, and 304 as *Hypnum molle,* (Ed. 2) 452; Aust. Musc. Appal. 437; Allen, Mosses Cascade Mts. 139; Grout, N. Am. Musc. Pl. 111, 111a, 220 & 278; R. & C. Musc. Am. Sept. Exsic. 140.

Frequent on stones and ledges in cool mountain brooks or northern streams. Northern U. S. and Canada across the continent, northwards to the arctic regions; south to N. Jersey, W. Virginia, Pennsylvania, Colorado and Utah.

Several varieties are described, mainly habitat forms. The enlarged hyaline outer stem cells furnish an easy and almost infallible means of identification.

Var. FLACCIDUM (Milde) Grout, including var. *complanatum* (Milde) Loeske [See Dix. & Jam. Handb. Brit. Mosses (Ed. 3) 544] is a large floating form, sometimes almost black, with leaves distant, not falcate, little or not at all secund, often somewhat complanate, reaching 2.5 mm. in length; costa long and forking. Often with the gross appearance of *Leptodictyum riparium.* Grout, N. Am. Musc. Pl. 240, 299 & 467.

Var. UNCINATUM (Milde) Loeske. Habit of *Drepanocladus,* ends of stems and branches hooked, all leaves strongly falcate-secund, often almost circinate, slender, long-acuminate.

Var. FILIFORME (Limpr.) Grout. Very slender, floating, with long slender branches, nearly julaceous; leaves appressed-imbricate not secund; leaves at ends of stems and branches imbricate into a straight erect tip.

N. Am. Musc. Pl. 386 seems to be near this variety. No. 380 is so different from all other forms examined that if it were not for the inflated outer stem cells one would never refer it to this species. The leaves are short-oblong to oblong-ovate, less than half the usual size, gradually and rapidly narrowed to the rounded obtuse serrate apex; costa strong, single. A similar form but with characters nearer those of the usual form is in the Canadian National Museum at Ottawa as "*Hypnum pseudomontanum* Kindb." from Port Etches, Alaska, June 18, 1892. Coll. Macoun. It is only a starved depauperate form. It is not at all like the type of *pseudomontanum* from Owen Sound.

2. HYGROHYPNUM PALUSTRE (Huds., Hedw.) Loeske, Moosfl. d. Harz. 319. 1903.

Hypnum palustre Huds. Fl. Angl. 429. 1762, & Hedw. Sp. Musc. 292. 1801.
Limnobium palustre Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 574.* 1853.
Hypnum luridum Hedw. Descr. **4**: 99. *pl. 38:* 1797.

Plants exceedingly variable, slender to robust, dark to yellowish-green, forming rather loose mats or patches; stems more or less prostrate, usually denuded of leaves at the base, irregularly branching; central strand of small cells; branches erect to ascending, sometimes curved or hooked at the ends; leaves close, variously arranged, sometimes imbricated all around the stems making them julaceous, more frequently secund, *entire, nearly always concave with the edges strongly incurved above, often making the upper leaf subtubulose,* narrowly to broadly oblong-ovate, 1–1.5 mm. long by about 0.6 mm. wide, exceedingly variable in the upper part, acuminate and obtuse or acute, or rounded-obtuse and apiculate; *costa variable in leaves from the same plant,* single and reaching the middle of the leaf or beyond, often forking, in other cases shorter and double or forking, sometimes faint; median leaf cells linear-rhomboidal, about 6 μ wide, 6–10 : 1, rarely longer; basal shorter and broader, *quadrate to short-rectangular; differentiated alar cells relatively few, about 14 μ wide, usually rather opaque* and granulose; *below these a few somewhat inflated cells at the very base of the somewhat decurrent angles* (these are usually left on the stem when the leaves are removed); alar and basal cells often highly colored. Monoicous; seta 15–20 mm. long; capsule short-oblong or oblong-ovoid, reaching 2.5 mm. in length, unsymmetric, cernuous to horizontal, strongly contracted under the mouth when dry and empty, brown to red; operculum conic, blunt to apiculate; annulus lacking; peristome perfect. Spores in summer.

Type locality European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Dixon & Jam. Handb. Brit. Mosses *pl. 69N; Pl. 23.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 305; Aust. Musc. Appal. 435; Grout, N. Am. Musc. Pl. 362; Allen, Mosses Cascade Mts. 140.

On rocks in and near cold streams, Northern U. S. and Canada, south to New Jersey, Pennsylvania and Colorado. Rare in the East, apparently common in the Rocky Mts.

Var. SUBSPHAERICARPUM (Schleich.) Amann, Fl. Mouss. Suisses 357. 1912.

Hypnum subsphaericarpon Schleich. Cat. 1807.

Robust, leaves large, falcate-secund, tapering and nearly tubulose above with the infolded edges; costa thick, reaching ¾ length of leaf or even to the apex. Capsule ovoid, short and thick, the urn almost as broad as long.

Michigan, Holt; British Columbia, MacFadden; Connecticut, Nichols.

Var. JULACEUM (Br. & Sch.) Loeske, Moosfl. d. Harz 320. 1903.

Hypnum palustre var. *julaceum* Br. & Sch. Bry. Eur. fasc. 55–56, *pl. 575.* 1853.

Branches ascending, nearly simple, julaceous; leaves broadly oblong to ovate, loosely imbricate, short-acuminate, concave; costa single, reaching the middle of the leaf or beyond, in some of the leaves often shorter and double or forked. Sporophyte as in var. *subsphaericarpon.*

New Mexico, British Columbia, Alaska and probably throughout the Rocky Mountain range of the species.

Hypnum pseudoarcticum Kindb. Bull. Torr. Bot. Club **17**: 280. 1890, from British Columbia, Macoun, sent to Dr. M. A. Howe by Kindberg himself is a form of *Hygrohypnum palustre* having the leaves rather abruptly short-acuminate and less infolded than usual, but characteristically infolded in some, not crenulate to any noticeable extent. Macoun's no. 373 from Sicamous, B. C., one of the type localities, is the same thing. Another specimen at the N. Y. Botanical Garden from Griffen Lake, B. C., another of the original localities, is, in the opinion of R. S. Williams and myself, a form of *H. dilatatum.* It is smaller than usual with very concave leaves, resembling *H. cochlearifolium* but easily distinguished by the more strongly decurrent and crenulate-serrate leaves. This is probably what Kindberg used as the type in describing his supposed species. The *H. pseudoarcticum* in the Canadian National Museum at Ottawa is a similar mixture with the addition of a form of *H. molle.*

Hypnum columbico-palustre C. M. & Kindb., Macoun, Cat. Can. Pl. 241. 1892. from "rocks at the mouth of the Illicillewaet Canyon, near Revelstoke, B. C., May 18, 1890. (Macoun)" is a not unusual wide-leaved form of *H. palustre.* The specimen studied is from the Canadian National Museum at Ottawa. It is from the type locality, collected at the same date as the type. The leaf form and leaf cells are much like Allen's Mosses of the Cascade Mts. no. 140, but the costa averages longer and stronger. The author considers this a form of the var. *julaceum* of *H. palustre. H. palustre* seems to be a species in an active state of evolution and it is difficult to draw specific lines. *H. alpestre, H. polare, H. styriacum* and possibly *H. eugyrium* are derivatives and are at times very difficult to distinguish from each other and from forms of *palustre.* On the other hand, in the even more variable *aduncus* and *fluitans* groups of *Drepanocladus,* the indications are that the variability is due largely to habitat conditions, especially variation in available moisture.

Hygrohypnum styriacum (Limpr.) Broth. is regarded by Limpricht himself as a subspecies of *palustre* and I have been unable to differentiate the American plants referred to *styriacum* from forms of *palustre.* It differs from the usual form of the narrow-leaved *palustre* in that the alar cells are less differentiated, there being scarcely any large cells at the extreme angles and the upper margins are not noticeably infolded, though the upper part of the leaf is quite concave.

Dixon (Handb. Brit. Mosses, 541) says of *H. palustre* "There are two distinct groups into which its varied forms may be separated, one with the leaves widely ovate, hardly tapering, obtuse or apiculate, imbricated all around the stems so as to render them julaceous, not or hardly at all secund (laxer and denser forms of this group are described under the names of var. *laxum* B. & S. and var. *julaceum* B. & S.); the other with the leaves more or less tapering above to an obtuse or, more rarely, acute point; to this group the two varieties described belong." (i. e. vars. *subsphaericarpon* B. & S. and var. *hamulosum* B. & S.)

Var. EHLEI (Arnell) **n. comb.**

Amblystegium Ehlei Arnell, Ark. For. Bot. **13**^{2}: 74. 1913.

Densely cespitose, cushions 1–2 cm. deep, quite rigid, glossy, bright yellow, darker below; branches more or less crowded, erect, curved at *the ends by the falcate-secund leaves; costa yellowish, strong, vanishing a little below the apex or percurrent;* leaf cells narrow, flexuose, 40–50 × 6 μ, *having thick cell walls;* alar cells a little broader, shorter, rectangular to quadrate, hyaline; branch leaves increasing in size from the base of the branch upwards, upper falcate-secund, about 1.3 × 0.65 mm., not decurrent, concave, narrowly ovate, *gradually narrowed to an obtuse or acute apex,* occasionally slightly dentate at apex; costa 0.04–0.065 mm. wide at base; leaf cells sometimes broader and shorter than described above.

Collected in the Lena valley, Siberia by N. Nilsson Ehle, and by S. Berggren in Greenland at Tessiursak in 1870 and distributed as *Hypnum polare.*

"Differs from the related *H. polare* in the secund and falcate leaves gradually narrowed from the base."

The above description and remarks are adapted and quoted from the original by Arnell. *Ehlei* approaches the form of var. *subsphaericarpum* from Michigan collected by Holt and distributed as *H. polare* but considered by the author to be an extreme form of *H. palustre*. This same form was collected at Kamloops, B. C., by Mrs. MacFadden.

The leaf cells do not materially differ from the descriptions of those of *polare* by various authors.

A specimen of *Amblystegium Ehlei* from the Lena valley, collected by Ehle, probably a co-type, has been very kindly sent me by Dr. Arnell himself. Var. *Ehlei* is intermediate between *H. palustre subsphaericarpum* and *H. polare*. From the former it differs chiefly in its less differentiated alar cells, occasionally crenulate leaf apices, and less tubulose upper leaf. From *H. polare* it differs chiefly in its more secund leaves, narrower and more narrowed toward the apex.

*3. HYGROHYPNUM PSEUDOMONTANUM (Kindb.) Grout, Check List 17. 1929.

Hypnum pseudomontanum Kindb., Macoun, Cat. Can. Pl. 6: 243. 1929.

Plants in rather thick loose mats, bright to dark green above, brown below; secondary stems and branches erect to ascending, 2–3 cm. long, little branched; lower leaves distant, minute and scale-like; *lower median leaves close, loosely erect-imbricate when dry*, brown, somewhat unsymmetric, 0.7–0.9 × 0.6 mm., very concave, *often cucullate, round-ovate to oblong-ovate, at apex rounded-obtuse, bluntly short-acuminate or apiculate*, often with apiculus incurved, entire, scarcely decurrent; *costa single, well developed and extending to the middle of the leaf; leaf cells oblong-hexagonal, 30–35 × 7 μ;* apical much shorter; basal shorter and broader; at basal angles a well-defined group of somewhat enlarged clear subrectangular cells; bordering these a group of small quadrate cells; *upper leaves smaller, hooked at ends of stem and branches, strongly* falcate and rather irregularly secund as in *H. montanum*, narrower, *more gradually acuminate, obtuse with upper margins incurved as in H. palustre.* Monoicous. Sporophytes not yet found. *Pl. 24B.*

Type from "Streams around Owen Sound, Ontario, especially below Jones Falls and the Potawatomie Falls, Sept. 15, 1890." Coll. Macoun. Typical specimens of the type collection from Potawatomie Falls have been studied. Brotherus considered this so near *H. palustre* that he did not transfer it to *Hygrohypnum* in the second edition of Engler & Prantl.

The upper portions of the plants do resemble *H. montanum* macroscopically, but if the lower leaves were all like the upper, one would refer it with little hesitation to a form of *H. palustre.* The lower leaves, however, are so different from the main run of *palustre* as to deserve at least subspecific rank when the very blunt apex of all the leaves is also taken into consideration. This species has also been collected on Anticosti Island by Brother Victorin.

4. HYGROHYPNUM POLARE (Lindb.) Broth. Engler & Prantl, Musci (Ed. 1) 1041. 1909.

Hypnum polare Lindb. Kgl. Vet-Ak. Förh. **23**: 540. 1866.

In rather dense soft masses, light to dark green; *secondary stems and branches erect, subjulaceous; leaves broadly oblong to oblong-ovate*, loosely imbricate, more or less appressed when dry, *slightly or not at all secund, very concave, rounded, subcucullate and often apiculate* but upper margins not infolded; *costa strong, extending nearly or quite to the apex, in some leaves projecting into an apiculus* much as in *Barbula unguiculata.* Dioicous. Sporophyte unknown.

ILLUSTRATIONS.—Broth. Laubm. Fennosk. 498. *f. A–B; Pl. 17A, figs. 13 & 14.* Greenland, Berggren; Yukon, Williams.

Several authors, including Husnot and Roth, seem to have confused this species with var. *subsphaericarpum* of *H. palustre* because of the very long strong costa of the latter. The upper leaf margins of *polare* are not infolded and it seems to be confined to the Far North. The plants collected by Holt and Cooper near Lake Michigan and referred to *H. polare* do indeed approach it in many respects, and the costa in some leaves projects into an apiculus, but I feel pretty sure they belong rather to *H. palustre subsphaericarpum.*

5. HYGROHYPNUM ALPESTRE (Sw., Hedw.) Loeske, according to Brotherus.

Hypnum alpestre Sw. Musc. Suec. 63. *pl. 6, f. 16.* 1799, and Hedw. Sp. Musc. 247. *pl. 64, figs. 1–4.* 1801.
Hypnum rivulare Sw. Vet.-Akad. Handl. Holm. 262. 1795.
Hypnum Krausei C. Muell. Flora **1887**: 224.

Plants in rather thick soft loose mats, yellowish green above, reddish to brown below; stems 3–10 cm. long, stout, prostrate, not radiculose; *branches erect, julaceous, blunt; leaves crowded, closely imbricate when dry*, sometimes slightly turned to one side, reaching 1.8 × 0.7 mm., *oval-oblong to elliptic-oblong, very concave,*

somewhat decurrent, rounded obtuse or shortly apiculate and often slightly serrulate at apex; margins plane; *costa strong, forking and reaching to or beyond the middle of the leaf, or single and reaching nearly to the apex; leaf cells thick-walled,* the median linear-flexuose, 5–7 μ wide, 8–12 : 1; apical shorter; basal shorter and broader; *at basal angles a small group of subquadrate cells, below these usually a few larger and somewhat inflated cells* which are hyaline in young leaves, but colored and with thicker walls when old. Monoicous; capsule 2.2 mm. long, elongate-ovoid, ± cernuous, chestnut, contracted under the mouth when dry and empty; annulus of 2–3 rows of cells. Spores in summer.

Type locality European.

Illustrations.—Hedw. l. c.; Bry. Eur. *pl. 577;* Husnot, Musc. Gall. *pl. 119;* Limpr. Laubm. **3**: *f. 428; Pl. 22D.*

Rare. On stones in far northern streams of Europe and N. America. Skagway and Lake Lindeman, Alaska; near Banff, British Columbia; Yoho National Park, B. C.; Greenland.

Williams says of the Alaskan specimens "In older leaves the very distinctly inflated cluster of alar cells is apparently always more or less deep red, sometimes the whole base becoming colored." Distinguished from *H. eugyrium,* its nearest relative, by the more robust habit, much stronger and longer costa, and usually less inflated alar cells.

Type duplicates of *Hypnum Krausei* have been studied and no essential difference between it and *alpestre* could be seen.

The group of inflated alar cells may be somewhat larger than is shown in the illustration.

Distinguished from *Calliergon turgescens* by the smaller size, smaller leaves, narrower leaf cells and crenulate obtuse leaf apex, which lacks the recurved apiculus so often present in *turgescens.*

Leaves may be found in which the development of the costa is almost identical in the two species, but in most of the leaves the costa is longer and very much stronger in *alpestre. H. alpestre* at times resembles also broad-leaved forms of the polymorphous *H. palustre.*

6. Hygrohypnum eugyrium (Br. & Sch.) Loeske, l. c.

Limnobium eugyrium Br. & Sch. Bry. Eur. fasc. 62–64, Suppl. 1, *pl. 579.* 1855.
Hypnum eugyrium Schimp. Syn. (Ed. 1) 639. 1860.

Plants in rather wide, dense, sand-filled mats or patches, bright green above, brown below, sometimes yellowish; stems prostrate; branches numerous, procumbent to erect; leaves erect-spreading when moist, loosely imbricate when dry, *usually more or less secund at the ends of stems and branches,* very concave with margins often infolded above, giving the plant *a turgid julaceous appearance;* leaves of the main branches and stems oblong-ovate to oblong-lanceolate, ± 1.4 × 0.5 mm., acute at apex, narrowed but not rounded at the more or less clasping base; leaves of smaller branches narrower, lanceolate; leaves often *denticulate at apex; costa very short and double or lacking;* median leaf cells linear-flexuose, about 6 μ wide, 6–10 : 1; apical cells shorter; basal not much different from the median except thicker-walled and usually colored (except in young leaves); *alar cells suddenly enlarged and inflated, the inner usually thick-walled* and colored, the marginal thin-walled and hyaline, or colored in old leaves, *forming distinct auricles.* Monoicous, capsules short, ovoid to oblong, 2–3 : 1; operculum convex-conic; annulus of two or three rows of cells, deciduous; peristome perfect. Spores in spring. Type locality, a waterfall in the Black Forest of Baden.

Illustrations.—Br. & Sch. l. c., M. H. M. 344.

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 303; Aust. Musc. Appal. 438; Grout, N. Am. Musc. Pl. 61, 129 & 323.

On rocks in streams in elevated regions, Newfoundland to Alaska, south or N. Carolina and Colorado, not rare.

The leaves of this species vary greatly; they may be broadly ovate or ovate-lanceolate, merely concave or with the upper margins infolded until they almost touch. The inflated alar cells vary in number from 3–5 in the lowest row next the insertion and from 2–3 along the margin, and these cells vary from 25–60 μ in length and from 21–37 μ in width. The amount of coloring and cell wall thickening of these cells is progressive with age. The leaves are often described as decurrent but I find this rare and only in a slight degree; the clasping base seems to have been mistaken for a decurrent angle. The costa is double and usually short, but occasionally one branch will reach fully to the middle of the leaf.

Var. *Mackayi* (Schimp.) Broth. is described as more robust with leaves scarcely secund and alar cells less conspicuously inflated, but in our American plants these variations do not seem to be correlated and it seems best to ignore this varietal name for them.

Dixon says of the British plants "the var. *Mackayi* does not appear to be very clearly marked off from the type, the characters given being none too constant."

Sematophyllum marylandicum (C. Muell.) E. G. Britton, is easily mistaken for this species, but its

enlarged alar cells are fewer in number and much more strongly inflated; also the leaves are much less concave and the upper margins are not infolded. In fruit its capsules are smaller and the operculum rostrate.

Forms of *H. palustre* approach *eugyrium*, but its extreme alar cells are never so much inflated and the number of small quadrate angular cells is greater; farther, *palustre* has entire leaves, usually rounded to the insertion.

*7. HYGROHYPNUM SUBEUGYRIUM (R. & C.) Broth. Engler & Prantl, Musci (Ed. 1) **2**: 1039. 1909.

Hypnum subeugyrium R. & C. Bot. Gaz. **22**: 5. *pl. 5*. 1896.

Plants dark dirty-green with a few light-green tips; leaves less concave and margins less infolded above than in *eugyrium*, shortly acute with serrulate apex; basal cells shorter and broader; enlarged alar cells few and small, surrounded by small quadrate to subrectangular cells. *Pl. 22A*.

Type from "Exploits, Newfoundland," Waghorne. Plant described from Exploits River below Grand Falls, Newfoundland, Fernald and Wiegand no. 6499, July 10, 1911. Also noted from Sweden, comm. Carl Stenholm. Subspecies of *eugyrium*.

This might easily be referred to *H. palustre* except for its serrulate leaf apices.

Var. OCCIDENTALE (Card. & Thér.) Grout, Check List 16. 1929.

Hypnum subeugyrium occidentale Card. & Thér. Proc. Wash. Acad. Sci. **4**: 342. 1902.

Plants light yellowish-green; leaves broader than in the typical form, especially above, softer, rounded to the apiculate entire apex which is often cucullate; alar cells more inflated in the subspecies but less inflated than in *eugyrium* itself, granulose but not colored; costa single and reaching beyond the middle of the leaf.

Type from Yakutat Bay, Alaska, Trelease no. 1784; also from Muir Glacier. Both collections seen. Also collected in British Columbia by Brinkman and Mrs. MacFadden (Kamloops, no. 697). The lack of color may be due to the youth of the specimens studied. Very close to *H. palustre julaceum* but the alar cells are rather larger. It seems probable that this form would be better classified as a form of this variety of *palustre*.

8. HYGROHYPNUM SMITHII (Sw.) Broth. Engler & Prantl (Ed. 1) **2**: 1039. 1909.

Leskea Smithii Sw. Liljebl. Sv. Fl. (Ed. 3) 544. 1816.
Hypnum arcticum Sommerf. in Wahl. Flor. Lapp. 65. *pl. 2*. 1826.
Limnobium arcticum Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 578*. 1853.

Plants in firm compact patches on stones in mountain brooks, brown to blackish, bright green at the young growing tips, *very slender, branches ascending to erect, rigid, harsh to the touch* when dry, more or less denuded of leaves below; leaves *spreading, not secund*, 0.5–1 mm. long, *broadly round-ovate to suborbicular, nearly or quite as broad as long, rounded and very obtuse at apex*, slightly decurrent, concave with plane entire margins; *costa stout, single*, reaching ½–⅚ the length of the leaf (rarely short and double); *median cells linear-elliptic, flexuose, thick-walled*, 7–9 μ wide, 4–6 : 1, shorter and rounder at apex and margins; basal shorter and broader; *differentiated alar cells few, incrassate, subrectangular* and colored, forming very small indistinct auricles. Monoicous; seta about 1 cm. long; capsule chestnut, elongated-ovoid, somewhat unsymmetric, cernuous or horizontal, reaching 1.5 mm. in length, operculum conic-apiculate; peristome perfect; annulus of two rows of cells. Spores in summer.

Type locality, Scandinavia.

ILLUSTRATIONS.—Br. & Sch. l. c.; *Pl. 23*.

EXSICCATI.—Drumm. Musc. Am. 194; Macoun, Can. Musc. 358 ?†

Very rare. British Columbia, California, Washington, Montana, Greenland, Cape Breton Island.

Hypnum torrentis C. M. & Kindb. Cat. Can. Pl. **6**: 243. 1892, is merely an exceedingly slender form of this species with leaves less than 0.5 mm. long, fully as broad as long. It is probably the same as var. *Goulardi* Husnot. Musc. Gall. 414. See Can. Musc. 403. The type in Kindberg's herbarium is a habitat form of swift cold waters.

9. HYGROHYPNUM COCHLEARIFOLIUM (Vent.) Broth. l. c.

Limnobium cochlearifolium Vent. in DeNot. Nat. Erb. Critt. Ital. 2nd series, Fasc. 10. 1871.
Hypnum Goulardi Schimp. Syn. (Ed. 2) 778. 1876.

Very close to *H. Smithii* from which it differs in *the shorter thinner double costa* and *exceedingly concave leaves*, which are at times almost hemispheric. Very rare.

Washington, Piper, no. 123, det. Brotherus; Electric Peak, Yellowstone National Park, Rydberg.

† Grout, N. Am. Musc. Pl. 259 is not this species but is nearer *Scleropodium apocladum* (Mitt.) than any species known to the author. The leaves are ovate and mostly obtuse, entire and rounded at apex, occasionally broadly acute and somewhat serrulate at apex; leaf cells not flexuose. The stems and branches frequently end in slender, almost flagelliform extensions. It would help greatly if it could be found in fruit. For it I propose the name *Scleropodium apocladum* var. OBTUSUM **n. var.**

10. HYGROHYPNUM NORVEGICUM (Br. & Sch.) **n. comb.**

Limnobium norvegicum Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 576.* 1853.
Hypnum viridulum Hartm. Skand. Fl. (Ed. 5) 524. 1849 (not Bridel, Mant. Musc. 179. 1819).

Plants slender, *in loose soft mats,* dark to yellowish-green; stems creeping, 1–3 cm. long, with short erect branches; leaves loosely appressed when dry, *widely erect-spreading when moist,* somewhat decurrent, somewhat concave, *entire, rounded-obtuse at apex;* stem leaves ± 0.7 × 0.5 mm., *broadly ovate; costa short and double;* branch leaves smaller and often proportionally narrower; median leaf cells thin-walled, 0.6 μ wide, 5–6 : 1; those at apex shorter; basal broader and shorter, oblong-rectangular; angular but a trifle different, about 9 μ wide. Autoicous; seta about 1 cm. long; capsule short-oblong, cernuous ± 2 mm. long; operculum mammillate; annulus of two rows of cells; peristome perfect. Spores in August.

Type locality European.

ILLUSTRATIONS.—Bry. Eur. l. c.; *Pl. 24C.*

The only North American record is from two Greenland localities reported by C. Jensen in the Flora of Greenland. In appearance it reminds one of a slender non-complanate form of *Plagiothecium elegans.* The leaves differ from those of *H. closteri* chiefly in the short double costa and proportionally broader outline. The habit is so different from the last as to make confusion of the two almost impossible.

11. HYGROHYPNUM CLOSTERI (Aust.) Grout, M. H. M. 346. July, 1910.

Hypnum closteri Aust. Musc. Appal. 439. 1870.
Amblystegium Holzingeri R. & C. Bot. Gaz. **19:** 240. *pl. 210.* 1894.

Plants very slender, in loose masses, often intermingled with *Hygroamblystegium* and other similar mosses; green to dirty yellow-green; stems creeping, irregularly branching, often somewhat denuded of leaves *below; leaves distant, widely spreading, rarely if ever secund;* stem leaves oblong-ovate to ovate, reaching 0.8 × 0.45 mm., usually narrower, slightly or not at all concave, broadly obtuse at apex, sometimes slightly unsymmetric, *quite entire, scarcely decurrent; costa single, reaching ½ length of leaf or longer,* sometimes shorter and forked; normal branch leaves smaller and less strongly costate; branch leaves of the sometimes almost flagelliform branches broadly ovate, obtuse, flat and often almost ecostate; *median leaf cells oblong-linear to fusiform with protoplasmic contents conspicuous,* about 7 μ wide, 3–5 : 1; apical and upper marginal shorter; basal shorter and broader; alar *slightly* enlarged; perichaetial leaves entire, costate, with narrow cells. Seta 6–8 mm. long, red-brown; capsule brown, ovoid, strongly unsymmetric, cernuous, strongly contracted under the mouth when dry and empty; annulus broad; peristome perfect; operculum depressed-conic and apiculate. Spores in spring.

Type, Austin's Musc. Appal. 439 from New York or New Jersey.

ILLUSTRATIONS.—R. & C. l. c.; *Pl. 24A.*
EXSICCATI.—Aust. l. c.

On stones in cool brooks, northeastern U. S., south to Virginia. Widely distributed but very rare or overlooked. Should be sought for in collections of *Hygroamblystegium.* Reported from Vermont, New York, New Jersey, District of Columbia, Virginia, and eastern Pennsylvania.

It resembles *H. palustre laxum* but is distinguished easily by the more obtuse leaves.

Forma SERRULATUM **n. f.**

Leaf cells broader, clearer; many leaves distinctly serrulate above. Bolivar Run, McKean Co., Pennsylvania. Burnett, no. 3208, Sept. 11, 1898. Type in herb. A. J. G.

12. HYGROHYPNUM MOLLE (Dicks., Schimp.) Loeske. l. c. 320.

Hypnum molle Dicks. Crypt. Fasc. **2:** 11, *pl. 5. f. 8.* 1790, and Schimp. Syn. (Ed. 2) 775. 1876.
Limnobium molle Br. & Sch. Bry. Eur. fasc. 55–56, *pl. 577.* 1853.
Limnobium submolle Kindb. Rev. Bryol. **22:** 87. 1895.

Plants in rather *loose soft* patches, *flaccid,* olive green to brownish; stems 5–10 cm. long, procumbent, irregularly and rather sparingly branched; *branches procumbent to ascending, long, tumid, and obtuse;* leaves of stem and main branches about 1.5 × 0.75 mm., spreading to erect-spreading, *not secund or falcate, broadly ovate, concave, soft, rather rapidly narrowed above the middle to a very broad rounded and obtuse apex, strongly narrowed and rounded to the insertion at base,* entire or finely serrulate above; *costa bi-trifid, usually short,* occasionally one stronger branch reaching the middle of the leaf or beyond; median cells about 7 μ wide, 5–8 : 1 (10–15 : 1, Dixon), broadly linear-flexuose; apical shorter; cells broader and shorter towards the base and becoming colored and short-rectangular to quadrate at the decurrent basal angles; perichaetial

leaves denticulate above. Monoicous; capsule ovoid, cernuous and unsymmetric, with a short and narrow neck, ± 2 × 0.65 mm., contracted under the mouth when dry and empty; operculum conic-apiculate; annulus of 3–4 rows of cells; peristome perfect. Spores in summer.

Type locality European.

ILLUSTRATIONS.—Dixon & Jam. Handb. Brit. Mosses, *pl. 59W; Pl. 22C.*

EXSICCATI.—Drumm. Musc. Am. 194; Grout, N. Am. Musc. Pl. 382; Allen, Mosses Cascade Mts. 142 (as *Hypnum arcticum*).

On stones in streams; arctic-alpine and infrequent. Northwestern U. S. and western Canada from the Rocky Mts. northward and westward.

The comparatively large size and broad rounded leaves make this and the next fairly easy to recognize, but the distinctions between the two do not always hold, as there are intermediate forms. Grout, N. Am. Musc. Pl. 442 is the same as 446. (See *H. dilatatum*), both the rigid habit and the widely spreading leaves indicate *H. dilatatum*, but some of the leaves on plants of 442 are almost as long as in *molle*, others are typical of *dilatatum*. Mrs. MacFadden has sent me from Revelstoke, British Columbia, a form growing on a submerged log, having the leaves somewhat secund but otherwise appressed-imbricate. Dr. C. M. Roberts has sent me a similar form from a similar habitat on San Juan Island, Washington. Under the microscope they are typical *molle*, but the appressed leaves give the plant a very slender and unusual appearance.

Another unusual form from the San Bernardino Mts., California, alt. 1000–1500 ft., on rocks in very rapid water about six inches deep, S. B. Parish no. 3884, Feb. 20, 1908, in the herbarium of the New York Botanical Garden, has small leaves, 1–1.2 mm. long, somewhat secund, concave; leaf cells ± 60 × 10 μ, with very conspicuous protoplasmic contents.

These plants were labeled "*Hypnum pseudoarcticum* Kindb." but they do not seem to correspond with any available material of that very doubtful species and they seem nearer *H. molle* than anything else known to me.

*13. HYGROHYPNUM DILATATUM (Wils. Mscr.) Loeske, l. c.

Hypnum dilatatum Schimp. Syn. (Ed. 2) 776. 1876.

Limnobodium molle Br. & Sch. Bry. Eur. *pl. 576 & 577.*

Hypnum circulifolium C. M. & K., Macoun, Cat. Can. Pl. **6**: 242. 1892.

Subspecies of *H. molle*. *Plants stiff and harsh to the touch when dry*, bright green at the young growing tips, brownish to almost black below; leaves often somewhat secund, *widely spreading, even when dry, from a narrow subclasping subdecurrent base, ovate-suborbicular, little longer than broad*, rounded and obtuse at apex, or sometimes apiculate, *finely serrulate in many cases;* "cells longer in the lower part of the leaf" (Dixon), frequently orange brown at base.

Type locality English.

ILLUSTRATIONS.—Br. & Sch. l. c.; Dixon & Jam. Handb. Brit. Mosses *pl. 60A;* M. H. M. 345.

EXSICCATI.—Aust. Musc. Appal. 436, as *Hypnum molle;* Grout, N. Am. Musc. Pl. 260, 446, & 442 as *H. molle.*

On stones in cool mountain brooks in northern U. S. and Canada across the continent, south to W. Virginia, Arizona and New Mexico. Mr. Williams and I both agree that the Alaskan plants which he referred to *Hypnum alpinum* (Schimp.) Loeske (Bull. N. Y. Bot. Garden **2**: 142, May 1901) are better referred to *H. dilatatum.*

See MF III 567

*14. HYGROHYPNUM BESTII (Ren. & Bryhn) Broth. Engler & Prantl, Musci (Ed. 1) **2**: 1040. 1909.

Limnobium Bestii Ren. & Bryhn, Rev. Bryol. **28**: 8. 1901.

Plants in deep loose cushions, pale olive-green, *rigid and rather harsh to the touch when dry;* stems stout, firm, 6–8 cm. long, generally defoliate below, divided into several erect branches; central strand lacking; leaves *distant, spreading, often squarrose above*, broadly ovate, concave, *very large, reaching 3 × 2 mm.*, narrowed from above the middle and obtusely acute at the apex, which is often slightly denticulate; *costa very strong, bifid, the longer branch often extending to the middle of the leaf or beyond;* median leaf cells linear-fusiform, *about 10 μ wide, 6–10 : 1*, the upper shorter; basal shorter and broader; differentiated alar cells few, slightly enlarged, rectangular, forming indistinct auricles. Fruit unknown.

Type from Avalanche Basin, Montana, alt. 1500 m. Co-type seen.

ILLUSTRATIONS.—Bryologist **4**: *pl. e.* 1901; *Pl. 26C.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 251; Allen, Mosses Cascade Mts. 141, as *Hypnum dilatatum.*

In alpine and glacial rivulets, Montana, Washington, British Columbia; "Alaska to California," Brotherus, l. c.

This is a subspecies of *H. molle*. It has the habit and appearance of *dilatatum* and the leaf form of *H. molle*. The leaf cells are larger than in either; N. Am. Musc. Pl. 251 is softer, with leaves less spreading than in the type. It is very close to *molle* but was determined by Dr. Best.

15. HYGROHYPNUM MONTANUM (Wils.) Broth. Engler & Prantl, Musci (Ed. 1) 1039. 1909.

Hypnum montanum Wils. Mscr., James, Proc. Acad. Nat. Sci. Phila. **1885**: 47.

Plants *almost as small* as *H. arcticum*, in wide soft mats, light to dark green above, reddish brown below; stems slender, prostrate, without central strand, mostly defoliate; secondary stems and branches numerous, suberect, 1–2 cm. long; *leaves falcate-secund to squarrose*, slightly decurrent, ovate to ovate-lanceolate, acuminate, acute at apex, about *0.75 × 0.3–0.35 mm., sharply serrate above, serrulate nearly or quite to the base; margins reflexed below; costa short and double;* median leaf cells about 5 μ wide, 6–10 : 1; basal and apical cells shorter; at basal angles a few short-oblong to quadrate cells scarcely forming auricles; leaf-like paraphyllia occasional. Monoicous; seta 1–2 cm. long, curved just below the capsule; capsules oblong-cylindric, unsymmetric and cernuous, about 2.5 mm. long, contracted under the mouth when dry and empty; operculum conic-apiculate; annulus large; peristome perfect. Spores in late spring to early summer.

Type from the White Mts. in New Hampshire.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl. 113; Pl. 22B.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 306; Aust. Musc. Appal. Suppl. 546; Grout, N. Am. Musc. Pl. 397 & 485.

On moist rocks in mountain brooks and along their banks; mountains of New England; Ontario, Newfoundland, also in northern Europe and Japan.

A small but very pretty and distinct species. When growing on boulders in brooks it seems to be on the surface of the stone between low and high water, while *H. ochraceum* grows lower down, submerged all the time.

16. HYGROHYPNUM NOVAE-CAESAREAE (Aust.) **n. comb.**

Hypnum Novae-Caesareae Aust. Musc. Appal. 440. 1870.
Hypnum micans Wils. in Hook. Brit. Fl. **2**: 86. 1833 (not Swartz, 1829).
Chrysobryum micans Lindb. in Sull. Icon. Musc. Suppl. 91. *pl. 67.* 1874.
Sematophyllum micans Braithw. Brit. Moss Fl. **3**: 154. *pl. 113B.* 1902.

Plants in thin tangled mats on stones in cold mountain streams, light green in most American plants, often glossy golden green in Great Britain; *main stems without central strand,* prostrate, 2–5 cm. long; branches few, slender, the branchlets often incurved; *both stems and branches long, slender and stoloniferous at the ends and bearing small distant leaves;* normal leaves rather close, erect-open, imbricated when moist, *subclasping and narrowly decurrent at base, sometimes slightly secund, broadly ovate to suborbicular, apiculate to shortly acuminate, concave with margins somewhat reflexed below, plane and serrulate above,* 0.6–0.8 mm. long; costa short and double or forking, often faint or wanting; median leaf cells linear-flexuose, 6–7 μ wide, 6–10 : 1; apical much shorter; basal somewhat shorter and broader; *alar quadrate to rectangular, somewhat enlarged, usually with a characteristic row of clear, hyaline or colored cells at the basal margin.* Dioicous, found in fruit but once, in western Pennsylvania; capsules small, obovate, nearly symmetric, cernuous to horizontal; *operculum shortly rostrate;* annulus of one or two rows of cells; *exothecial cell walls not collenchymatous; cilia of peristome* lacking.

Type locality British.

ILLUSTRATIONS.—Sull. l. c.; Braithw. l. c.; Jennings, Mosses Western Pa. *pl. 48;* M. H. M. 364. *f. 193.*

EXSICCATI.—Aust. l. c.; Grout, N. Am. Musc. Pl. 306.

In mountainous regions, Vermont to Georgia, west to western Pennsylvania. Rare and local in most places, frequent in the mountains west of Asheville, N. Carolina.

Apparently most American plants are the large form with better-developed costa and larger alar cells described by Herzog (Rev. Bryol. **28**: 76. 1901), as var. *badense.*

8. SCORPIDIUM (Schimp.) Limpr. Laubm. **3**: 570. 1899.

Hypnum subgenus *Scorpidium* Schimp. Syn. (Ed. 1) 650. 1860.

We have one species only. Its relationships have been a standing puzzle to systematists. Assigned to *Amblystegium* by Lindberg, to *Calliergon* by Sullivant, to *Harpidium* by Milde and to *Limnobium* by Dixon. Moenkemeyer has referred *Calliergon turgescens* to this genus, but this seems to the author not justified by the facts, although the superficial resemblance is often great.

SCORPIDIUM SCORPIOIDES (L., Hedw.) Br. & Sch. Bry. Eur. *pl. 612.* 1854.

Hypnum scorpioides L. Sp. Pl. 1127. 1753, & Hedw. Sp. Musc. 296. 1801.
Hypnum subturgescens Kindb. Ottawa Nat. **23**: 137. 1909.

Plants very robust, one of the largest of mosses, reaching 3 dm. in length; divisions little branched or with short branches; forming large soft masses of a dark or brownish green, often reddish, sometimes nearly black; branches and branchlets curved at ends, very turgid by reason of the very concave imbricated leaves; leaves more or less falcate-secund; stem leaves 2–4 × 1.4–2 mm., not much plicate but rugose when dry, broadly ovate-oblong, narrowed to the insertion, not decurrent, abruptly narrowed to an obtuse or apiculate apex, entire (occasionally acute or acuminate and slightly denticulate at apex); costa faint, short and double, or even lacking; median leaf cells narrowly linear-flexuose, 15 : 1, thick-walled, a few cells at the insertion shorter and wider, a few at extreme angles somewhat inflated and thinner-walled. Dioicous: seta very long, 4–6 cm.; capsule strongly curved from an erect neck, plicate and contracted under the mouth when dry; peristome perfect; annulus very large. Spores in late summer. Distinguished from *Calliergon* by its aquatic habitat, great size and dark color. *Drepanocladus Wilsoni* approaches it in size, but in *D. Wilsoni* the leaves are costate and slenderly acuminate.

Illustrations.—Bry. Eur. l. c.; Dixon & Jam. Handb. Brit. Mosses, *pl. 60E; Pl. 27C.*

Exsiccati.—Drumm. Musc. Am. 200; Sull. Musc. Allegh. 27; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 310, (Ed 2) 459; Aust. Musc. Appal. 446; Grout, N. Am. Musc. Pl. 449 & 449a.

There are slender forms with leafy stems not more than ½ the diameter of the normal form.

Plants of bogs and wet places, often submerged and floating; widely distributed but apparently infrequent and local. Northern U. S. and Canada across the continent, south to New Jersey, Ohio, Michigan, and Montana.

9. CALLIERGON (Sull.) Kindb. Eur. & N. Am. Bryin. **1:** 79. 1896. (in part).

Hypnum subgenus *Calliergon* Sull. Mosses of the U. S. 72. 1856.

Plants of swamps and wet places, more or less robust, growing in loose masses, sometimes intertangled with other mosses, green, yellowish-green, or reddish purple. Stems with central strand, mostly elongated when submerged or in deep swamps, erect or ascending with few radicles; in dry situations more prostrate and sparingly radiculose; sparingly branched (except *C. giganteum*). Stem leaves spreading to erect-imbricate, usually concave, seldom much plicate, *ovate to suborbicular, mostly with rounded and more or less cucullate apices* (a few species apiculate or short-acuminate), *with plane entire margins. Costa strong, often percurrent or nearly so. Median leaf cells linear to elongated linear-hexagonal;* basal and alar shorter and broader, *alar thin-walled, hyaline and more or less inflated when young* (except in *Pseudocalliergon*); branch leaves smaller and narrower. Seta long reddish, smooth; capsules oblong-ovoid to subcylindric, more or less arcuate and cernuous, usually somewhat contracted under the mouth when dry; operculum conic to conic-apiculate; annulus lacking to broad.

Type species *C. cordifolium* (Hedw.) Kindb.

Key.

1.	Alar cells thick-walled and more or less colored, ordinarily little different from the other basal cells; costa thin, often faint (*Pseudocalliergon*)	2.
	Alar cells thin-walled, hyaline and more or less inflated; costa strong and conspicuous, often nearly percurrent (*Eucalliergon*)	3.
2.	Plants turgid with the large concave, often apiculate leaves; angular cells smaller than other basal cells, quadrate	*9. turgescens.*
	Plants more slender, not turgid; leaves rounded and blunt at apex; basal and angular cells sometimes slightly inflated	*8. trifarium.*
3.	Costa not extending farther than ¾ the length of the leaf	4.
	Costa reaching nearly or quite to leaf apex	5.
4.	Slender, yellowish-green to straw-color; stem leaves usually suberect and imbricated when dry, oblong to ovate-oblong	*7. stramineum.*
	More robust, brighter green; stem leaves spreading to erect-spreading, broadly cordate-ovate to suborbicular	*2. Richardsoni.**
5.	Stem leaves much longer than broad, oblong to oblong-ovate	6.
	Stem leaves nearly as broad as long, widely cordate-ovate	9.
6.	Plants purplish or red when old	7.
	Green or brownish below, rarely with any tinge of red	8.

* *Orbiculari-cordatum* may be sought here.

7. Leaves oblong-lanceolate, acuminate and acute	*6. pseudosarmentosum.*
Stem leaves oblong, rounded and obtuse, often cucullate and apiculate at apex	*5. sarmentosum.*
8. Branches few and irregular; autoicous	*1. cordifolium.*
Branches usually numerous and more or less pinnately arranged; dioicous	*4. giganteum.*
9. Median leaf cells linear, about 8: 1.	*4. giganteum cyclophyllotum.*
Median leaf cells oblong-hexagonal to oblong-linear, 4–5: 1	*3. orbiculari-cordatum.*

1. CALLIERGON CORDIFOLIUM (Hedw.) Kindb. Eur. & N. Am. Bryin. **1**: 80. 1896.

Hypnum cordifolium Hedw. Musc. Frond. **4**: 97. *pl. 37.* 1797 & Sp. Musc. 254. 1801.

Usually robust and tall, reaching 20 cm., bright or yellowish green above, brown below, more or less erect, stems *usually divided but with few short branches;* stem leaves more or less spreading, closely imbricate into a bud at the stem ends, *soft, somewhat shrinking when dry,* with plane entire margins, 2–5 mm. long cordate-ovate ot ovate-oblong, somewhat concave, *rounded at apex and usually cucullate, at base rounded and narrowed to the long-decurrent insertion;* branch leaves smaller, oblong-lanceolate; costa single, reaching within a few cells of apex; median leaf cells 90–150 × 8–12 μ, linear, pointed, thin-walled; marginal narrower, apical shorter and broader; *cells toward the base gradually becoming shorter and wider across the whole base; alar cells larger, not sharply delimited,* thin-walled and hyaline, more or less inflated. Autoicous; seta 5–8 cm. long; capsules large, oblong-arcuate, cernous to horizontal, reaching 4.5 mm. in length, light brown to chestnut; operculum conic to conic-apiculate; annulus lacking; peristome perfect hypnaceous. Spores in late spring.

Type locality European.

Common in swampy places and pools and even in shallow sluggish streams across the northern part of the continent, south to New Jersey, Pennsylvania and Ohio.

ILLUSTRATIONS.—Bry. Eur. *pl. 615;* M. H. M. *pl. 76;* Jennings, Mosses W. Pa. *pl. 40.*

EXSICCATI.—Drumm. Musc. Am. 209; Sull. & Lesq. Musc. Bor. Am. (Ed. 1), 309 (Ed. 2) 457; Austin, Musc. Appal. 441, 442; Sull. Musc. Allegh. 34; Grout, N. Am. Musc. Pl. 40, 209a.

This species varies a great deal in robustness. One of the slender forms has been described as var. *angustifolium* (See Limpricht, Laubmoose **3**: 549). There is also a great variation in the alar cells; in western plants, especially those from west of the Rockies, the alar cells tend to become as much inflated and as sharply delimited as in the next. Provisionally this western form is called

Forma INTERMEDIUM **n. forma,** Type, Grout, N. Am. Musc. Pl. 209, which Thériot identified wrongly as *C. Richardsoni.* Allen's Mosses of the Cascade Mts. no. 127 is also this form. This form has the percurrent costa of *cordifolium* while that of the next stops far short of the apex.

*2. CALLIERGON RICHARDSONI (Mitt.) Kindb. Eur. & N. Am. Bryin. **1**: 80. 1896.

Stereodon Richardsoni Mitt. Journ. Linn. Soc. **8**: 42. 1865.
Hypnum Richardsoni L. & J. Manual 404. 1884.
Hypnum Breidleri Jur. Hedwigia, **14**: 182. 1875.
Hypnum subgiganteum Kindb. Ottawa Nat. **14**: 80. 1900. (Type seen.)

Subspecies of *C. cordifolium,* from which it differs in the less spreading leaves which are less distantly placed, giving the stems, especially in European plants, a stouter appearance; *the costa extends from ⅔–¾ the length of the leaf only; the inflated hyaline alar cells are sharply delimited,* forming conspicuous decurrent auricles.

Type locality American. "Supposed by Drummond to be from the Great Bear Lake." A specimen, evidently the type, in Herb. Mitten at the N. Y. Botanical Garden has been seen.

Northern U. S. and Canada, Vermont, Isle Royal in Lake Superior and also in "boggy ground north of Lake Superior," Newfoundland, Prince Edward Island, Greenland. Dixon considers the specific value of *C. Richardsoni* as "very doubtful" and it will doubtless be found to intergrade with both *C. cordifolium* and *C. giganteum. Pl. 17A, figs. 10–12.*

*3. CALLIERGON ORBICULARI-CORDATUM (R. & C.) Broth. Engler & Prantl, Musci, (Ed. 1) 1037. 1909.

Hypnum orbiculari-cordatum R. & C. Bull. Herb. Boissier **4**: 19. 1896.

"Tufts very soft, pale lurid green above, decolored, whitish-yellow and brownish-variegated below." "Stems slender, erect, 4–9 cm. high, simple or sparingly branching, not radiculose, cuspidate at apex." "Leaves soft, erecto-patent or very loosely imbricate, subundulate when dry, decurrent at base, *broadly*

cordate-suborbicular, very obtuse, quite entire, slightly sulcate; *costa thin*" sometimes vanishing far from the apex, usually as in *cordatum; "areolation loose, pellucid, cells soft, thin-walled, rhomboidal-hexagonal in the middle*, the marginal narrower, the upper shorter, the alar very loose, large, soft and empty." "Flowers and fruit unknown." Type from "Northwest shore of Hudson's Bay: Depot Island, N. Lat. 63°, 79′; W. Long. 90°, 20′ (George Comer, 1893, comm. D. C. Eaton). Type in Herb. Cardot, at the Nat. Hist. Museum, Paris.

Type duplicate R. & C. Musc. Am. Sept. Exsic. 249. Seen at N. Y. Bot. Garden.

Illustrations.—Bot. Gaz. **22**: 5. *pl. 4B.* 1896; *Pl. 19B.*

A good species, related *C. cordifolium*, from which it is "Easily distinguished . . . by the stems nearly simple, the leaves very soft, broader, and the looser areolation." (Quotations from the Bot. Gaz. description.)

Grout, N. Am. Musc. Pl. 370 is apparently a type duplicate, though the latitude is given on the label as N. Lat. 63°, 31′ instead of 63°, 79′ given as the type locality. Otherwise the labels match exactly. The costa is usually as nearly percurrent as in *cordifolium* and is so shown in one of Cardot's figures. The median leaf cells as shown in his figures are characteristic and unmistakable.

4. Calliergon giganteum (Schimp.) Kindb. l. c.

Hypnum giganteum Schimp. Syn. (Ed. 1): 642. 1860.
Hypnum cordifolium var. *stenodictyon* Br. & Sch. Bry. Eur. Mon. Hypnum 47. 1854. (no plate).
Stereodon giganteus Mitt. l. c. 43. 1865.

Plants aquatic to subaquatic, often nearly submerged, in deep loose masses, dark green, brown or reddish below, usually very robust, 7–30 cm. long; stems ascending to erect, bearing few or no radicles; *branching almost regularly pinnate with numerous close branches of a somewhat irregular length;* ends of stem and branches usually somewhat cuspidate; stem leaves large, 3–4 × 1.4–2 mm., more or less plicate when dry, widely cordate-ovate, spreading to erect-spreading, in the larger forms somewhat appressed-imbricate and crowded, in slender forms with fewer and shorter branches, the leaves are as distant and spreading as in *C. cordifolium*, somewhat decurrent, obtuse and cucullate at apex with the apical margins sometimes inrolled until they nearly meet, margins otherwise plane and entire; *costa broad and strong*, usually tapering but little until it vanishes in the apex; median leaf cells long linear-flexuose, 100–140 × 7 μ, narrower toward the margins, apical cells twice as wide, 3–4: 1; alar cells forming auricles, large, *abruptly inflated*, thin-walled and hyaline, 30–40 μ wide, mostly oblong-hexagonal, in some cases reaching almost to costa but usually separated from it by several smaller thick-walled cells; branch leaves smaller and narrower, oblong to oblong-lanceolate. Dioicous; sporophyte much as in *C. cordifolium* but rarely produced. Spores in late spring.

Type locality European.

Illustrations.—Limpricht, Laubmoose **3**: 553, *f. 432;* Dixon & Jam. Handb. Brit. Mosses *pl. 60 J; Pl. 19A.*

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 458, 468; Aust. Musc. Appal. 443; Grout, N. Am. Musc. Pl. 253, 253a, 354 & 484; Allen, Mosses of the Cascade Mts. 138; Dutton, Vt. Musci 334.

In cool swamps, northern U. S. and Canada across the continent, south to Pennsylvania and New Jersey. Not rare but rather infrequent and local. The darker color, closely pinnate branching and more crowded leaves distinguish this species markedly from *C. cordifolium* in well developed forms. In slender forms seemingly partial to cedar swamps, as in the exsiccati of Austin and Dutton, the plants are more slender than in most *cordifolium*, the leaves are as distant and the branches comparatively few and short; the sharply delimited inflated auricular cells will usually serve to enable identification of such forms. There are, however, numerous puzzling intermediate forms, and forma *intermedium* of *cordifolium* has alar cells almost as inflated and sharply delimited as in *giganteum.*

Mitten's remark that the American forms of this species are more slender than the European is true in general, but we have forms, particularly in the West, that are as robust as the European.

Var. cyclophyllotum (Holzinger) Grout, **n. comb.**

Hypnum cyclophyllotum Holzinger, Minn. Bot. Stud. Bull. **9**: 691. *pl. 39.* Nov. 1896.
C. giganteum var. *brevifolium* Limpr. Laubm. **3**: 555. 1899. (According to R. S. Williams.)

Small, 8–10 cm., little branched; stem leaves very broad and short, in some cases fully as broad as long, but usually at least 1–1.5 : 1; median leaf cells shorter and broader, especially in the lower ⅓ of the leaf. Described from "Part of the type" communicated by Holzinger. Other plants with similar stem leaves have been observed from different localities but they differ so much in branching or slenderness that it has not seemed best to refer them to this variety. *Pl. 19C.*

Var. FLUITANS (Klinggr.) Roth, Europ. Laubm. **2**: 574. 1904.

Hypnum giganteum fluitans Klinggr. Leberm. and Laubm. 292. 1893.

A large floating form; leaves reaching 4.5 × 3 mm., distant; branches few, irregular. Near March Lake, Yukon Terr. and Columbia Falls, Montana, Williams.

Resembling *Fontinalis gigantea* Sull. and growing in similar situations. The leaves may graduate down to those 1 mm. in length.

Var. DENDROIDES (Limpr.) Grout, Check List, 17. 1929.

Hypnum giganteum var. *dendroides* Limpr. Laubm. **3**: 555. Nov. 1899.

Plants with lower branches often long and all the branches with more or less numerous branchlets; stem leaves 3.6 × about 2 mm. Columbia Falls, Montana. Williams.

Var. *labradorense* (R. & C.) Grout. Check List, 17. 1929. *Hypnum labradorense* R. & C. Bot. Gaz. **19**: 240. 1894.

"Distinct from the type by the leaves larger and longer and the costa attenuate, vanishing rather far from the apex and often forking. Battle Harbor, Labrador, Waghorne." Poorly characterized and should be ignored.

5. CALLIERGON SARMENTOSUM (Wahlenb.) Kindb. l. c.

Hypnum sarmentosum Wahlenb. Fl. Lapp. 380. 1812.
Calliergon subsarmentosum Kindb. Ottawa Nat. **23**: 137. 1909.

Plants in deep thick tufts or mats, *characteristically dark purplish-crimson*, green at the growing tips; stems 8–15 cm. long, more or less denuded of leaves below, not radiculose, *irregularly and sparingly branched;* stem leaves rather close, irregularly spreading to loosely imbricate, *elliptic-lanceolate to narrowly oblong*, narrowed and decurrent at base, reaching 2.5 × 1 mm., often smaller, *concave and cucullate at apex*, obtuse or shortly apiculate; margins entire and plane except at the inrolled apex; costa extending almost to apex; median leaf cells narrowly linear-flexuose, about 6 μ wide and 10–15 times as long, rather thin-walled, growing shorter, broader and thicker-walled towards the base; cells at the insertion oblong-rectangular, incrassate and colored; *the outer thin-walled, inflated and often hyaline, forming well-defined decurrent auricles;* branch leaves smaller, oblong-lanceolate, often acute to acuminate. Dioicous; capsules rarely produced, smaller and narrower than in the preceding species; annulus lacking; operculum long-apiculate. Spores in early summer.

Type locality European.

ILLUSTRATIONS.—Bry. Eur. *pl. 616; Pl. 20.*

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 311b as *Hypnum stramineum* var., (Ed. 2) 461; Grout, N. Am. Musc. Pl. 400a.

Cold bogs, northern New England and eastern Canada, Newfoundland, Greenland. Rare and local. Musc. Bor. Am. 311b has the shorter costa of *C. stramineum* but it has the color and the apiculate upper leaves of *sarmentosum.*

Specimens from Vancouver Id. collected by Macoun on July 13, 1906, labeled *Calliergon subsarmentosum* Kindb. fit the original description. The inflated alar cells are very large and extend to the costa. The costa is very stout, over 0.1 mm. in width and none of the leaves seem to be apiculate. It is merely a slight variation.

Hypnum hyperboreum Bryhn, Rept. 2nd. Norw. Arctic Exped. in the Fram, No. 11: 134. 1906.

Through the kindness of Dr. Johnnes Lid of the Botanical Museum of the University of Oslo, I received a portion of the type of this species.

It is undoubtedly a form of *C. sarmentosum*, a delicate and depauperate arctic form slightly colored and differing in no essential detail of leaf structure.

Var. BERINGIANUM (Card. & Thér.) **n. comb.**

Differs from the typical form in the slender, more loosely foliate stems; costa broader, nearly 0.1 mm. wide, with inflated alar cells much smaller and much less numerous. Type collection, Trelease no. 1889, St. Matthew Id., has been studied through the courtesy of the Missouri Botanical Garden.

Var. FONTINALOIDES (Berggren) Grout, Check List. 1929.

Hypnum sarmentosum var. *fontinaloides* Berggren in Hartm. Skand. Fl. (Ed. 10) 4. 1871.

Stems long and slender, floating, with longer leaves, green or green and purple mixed; cell walls less thickened. More arctic-alpine than the species.

On rocks in bottom of a small stream near mouth of Bonanza Creek, Yukon Territory. Williams.

Concerning these forms Limpricht says (Laubm, **3**: 561) "similar forms are developed by *C. giganteum* and other bog mosses when they float in quiet water.

Var. FALLACIOSUM (Milde) Broth. Laubm. Fennosk. 489. 1923.

Hypnum sarmentosum var. *fallaciosum* Milde, Bryol. Siles. 369. 1869.

Appearance of *C. stramineum*, stems reaching 10 cm. long, slender, in deep compact tufts. Grout, N. Am. Musc. Pl. 400b from Bonne Esperance, Labrador, seems to fit this though the color is darker than described by Limpricht.

6. CALLIERGON PSEUDOSARMENTOSUM (Card. & Thér.) Broth. Engler & Prantl, Musci (Ed. 2) **2**: 348. 1925.

Hypnum pseudo-sarmentosum Card. & Thér. Univ. of Calif. Pub., Botany **2**: 305. *pl. 27. f. 2.* 1906.

Plants *in dark purplish masses;* stems erect, 5–6 cm. long (original description says 8–10); irregularly to subpinnately branching; *branches numerous, cuspidate, unequal;* stem leaves erect-spreading from a subclasping base, not cucullate, ± 2 × 0.8 mm.; branch leaves smaller, imbricate when dry; all leaves broadly *lanceolate to oblong-lanceolate, acuminate, acute at apex; margins slightly inflexed above, entire;* costa stout, 60–70 μ thick at base, vanishing just below the apex; median cells narrowly linear, about 6 μ wide, 9–15: 1; alar cells suddenly enlarged and inflated below a row or two of small short-oblong cells; costa and basal cells colored; outer alar cells nearly or quite hyaline; inner perichaetial leaves abruptly acuminate with an excurrent costa. Capsules (including operculum) about 2.5 mm. long, subcylindric, curved and unsymmetric; operculum long-conic, subrostrate. Spores in late summer.

Type seen; from Cape Nome, Alaska, Setchell and others. Type in herb. Univ. of California.

ILLUSTRATIONS.—Thér. l. c.; *Pl. 25A.*

This species has the gross appearance of *C. sarmentosum* but it is beautifully distinct and easily recognized by the acuminate and acute, non-cucullate leaf apices. It has not been reported since the original collection.

7. CALLIERGON STRAMINEUM (Dicks., Brid.) Kindb. l. c. 81.

Hypnum stramineum Dicks. Fasc. Pl. Crypt. **2**: 6. *pl. 1, f. 9.* 1790.

Hypnum stereodon stramineum Brid. Musc. Rec. **2²**: 172. 1801.

Plants *very slender*, in deep soft masses, *yellow green to straw color*, darker below; stems 10–20 cm. long, erect or ascending, simple or *sparingly branched*, not radiculose or denuded of leaves below, often cuspidate by the convolute appressed leaves in American plants; stem leaves rather crowded, erect-open to erect-spreading when moist, when dry *loosely appressed-imbricate* and somewhat plicate, 1.5–2 × .07–.09 mm., *oblong to linguate*, entire, concave, *obtuse, rounded, and somewhat cucullate at apex*, decurrent, producing tufts of radicles on the back of the apex more often than the other species of the genus; median cells linear, about 6 μ wide, 8–15: 1; lower cells shorter and broader toward the base, at angles suddenly enlarged, inflated, hyaline, *forming well-defined decurrent auricles;* apical widely rhomboidal to roundish-quadrate; costa reaching ¾–⅚ the length of the leaf. Dioicous; seta 4–8 cm. long, reddish; capsule oblong-cylindric, curved and cernuous, 3–4 mm. long; operculum convex-conic; annulus lacking. Spores in late spring, rarely produced. Type locality European.

ILLUSTRATIONS.—Br. & Sch. Bry. Eur. *pl. 617; Pl. 20.*

EXSICCATI.—Drumm. Musc. Am. 210; Sull. Musc. Allegh. 38; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 311, (Ed. 2) 460; Aust. Musc. Appal. Suppl. 547; Grout, N. Am. Musc. Pl. 283, 370; R. & C. Musc. Am. Sept. Exsic. 345.

Infrequent and local; in cool bogs, especially at high altitudes; often mixed with *Sphagnum* and other bog mosses. New England; Adirondacks; Michigan; Wyoming, and in Canada across the continent.

8. CALLIERGON TRIFARIUM (Web. & Mohr.) Kindb. l. c. 85. 1896.

Hypnum trifarium Web. & Mohr. Iter Suec. 177, *pl. 2, f. a–d.* 1804.

Hypnum illecebrum Schultz, Fl. Starg. 308. 1806 (non syn.)

Hypnum stramineum var. *foliis latioribus.* Schwaegr. Suppl. **1²**: 212. *pl. 89.* 1816.

Plants resembling *C. stramineum* but stouter, with julaceous, slightly turgid stems, bright green above, brown below; stem leaves 1.5–2 × 1.2–1.7 mm., *appressed-imbricate both moist and dry*, often finely striate when dry, *widely ovate to suborbicular, widest at about the middle, spoon-shaped and very obtuse*, entire,

scarcely decurrent; costa extending beyond the middle, often very thin in American plants; median leaf cells thick-walled, linear-flexuose, about 6 μ wide, 8–12: 1, *shorter but not broader at the apex;* all basal cells shorter and broader, especially a row or two of short-oblong cells at the insertion *which are little different at the basal angles* as a rule. Dioicous; sporophyte not yet found in N. America, differing but little from that of *C. stramineum* except in the well developed annulus of 3–5 rows of cells. Spores in early summer.

Type locality, Switzerland.

Illustrations.—Bry. Eur. *pl. 618; Pl. 21.*

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 462, (Ed. 1) 312; Sull. Musc. Allegh. 39; Grout, N. Am. Musc. Pl. 350.

Deep cold bogs. Connecticut, Ohio, Ontario, Labrador, Greenland and northwards in Canada across the continent; very rare, often associated with *Scorpidium* and *C. turgescens.* Dr. G. E. Nichols writes that he has collected this species along the Straits of Mackinac in Michigan where it is abundant in shallow open calcareous bogs where the water becomes quite warm at times and also in northern Maine where it grows in great abundance submerged on the bottom of lakes 6–8 feet below the surface. In these places and in Connecticut he states that it is locally abundant.

9. Calliergon turgescens (Schimp.) Kindb. l. c. 84.

Hypnum turgescens (Schimp.) Syn. (Ed. 1) 648. 1860. See MF III 268

Plants in dense soft masses, *golden yellow* to olive-green, brownish to reddish below, sometimes incrusted with lime, very robust, *tumid; leafy stems 4 mm. thick,* sparingly branched; stem leaves reaching 3.3 × 1.2 mm. close, loosely to rather closely imbricate, not decurrent, but subclasping, ovate-oblong, very concave, cucullate and obtuse at apex or often with a *minute recurved apiculus,* entire; *upper leaf cells wide and short* for the genus, reaching 8 μ wide, 5–8 : 1, oblong-linear; the lower longer; those at base oblong to rectangular, *incrassate, porose* and often colored; at the *basal angles are a few smaller, rounder-quadrate cells; costa short and thin,* reaching about ⅓ the length of the leaf, or short and double or forked. Dioicous; sporophyte known from 2 localities in Sweden only. Reproducing asexually by the falling off of the terminal buds of slender stolons.

Illustrations.—Dixon & Jam. Handb. Brit. Mosses, *pl. 60H* (In this figure the costa is stronger and longer than seems typical.); *Pl. 26B.*

Exsiccati.—Macoun, Canadian Musci 483.

The rarest of the genus, apparently calcicolous; found in cold bogs often associated with other bog mosses. Davis Straits, Taylor; Rocky Mts., British Columbia, Macoun (several localities); Owen Sound Ontario, Moxley; Greenland.

Likely to be confused with *Hygrohypnum alpestre.* For distinctions see that species. Stunted forms with leaves less than 1.5 mm. long are found in Greenland.

10. CALLIERGIDIUM (Ren.) Grout, Ck. List 17. 1929.

Calliergidium (subgenus) Ren. Bryologist **5**: 64. 1902.

Pseudocalliergon Ren. Bryologist **4**: 64. 1901. (Not Limpr. Laubm. **3**: 547. 1899.)

Plants inhabiting swampy regions, forming loose tufts, some of the species having the general aspect of certain species of *Drepanocladus,* another reminding one of *Calliergon.* Leaves rather distant, imbricate, occasionally somewhat secund, especially at the tips of stems and branches, *obtusely acuminate;* costa single, reaching the middle of the leaf or beyond, rarely short and forking in some leaves; median leaf cells linear, apical and basal shorter and usually broader, alar inflated and hyaline. The acuminate leaves distinguish this from *Calliergon* (except *C. pseudosarmentosum*) and the obtuse apex from *Drepanocladus* (except a few varieties).

The mosses of this type seem to be forms of deep bogs, and certain varieties of *Drepanocladus* have been referred to this genus. Indeed species referred here by Renauld are blunt-leaved *Drepanocladi. Hypnum tundrae* Arnell is considered by Warnstorf and Brotherus to be a mere *form* of *Drepanocladus exannulatus* and *H. pseudostramineum* to be a form of *D. fluitans.* The fact that there is considerable difference in the acuteness of different leaves from the same plant is an argument in favor of putting all these forms under *Drepanocladus* as is done by Brotherus in the second edition of Engler & Prantl. The obtuse leaves of var. *obtusifolium* of the normally very acute-leaved *Leptodictyum riparium* furnish another argument for this view.

However, the general appearance and form of leaves is so different from that of *Drepanocladus* that it will be far more convenient to treat some of these forms under a separate genus, following the lead of that greatest of students of *Drepanocladus* (*Harpidium*), Mons. F. Renauld.

Type species, *C. Bakeri.*

KEY.

1. Leaves broadly ovate to ovate-elliptical, as a rule rather abruptly short-acuminate ..... 2. *Bakeri.*
   Leaves lanceolate to triangular ovate, gradually narrowed to the narrowly obtuse apex ..... 2.
2. Leaves with inflated angular cells forming decurrent auricles ..... 1. *pseudostramineum.*
   Leaves with slightly inflated alar cells, not decurrent ..... 1. var. *Hoveyi.*

1. CALLIERGIDIUM PSEUDOSTRAMINEUM (C. Muell.) Grout, l. c.

Hypnum (subgenus *Calliergidium*) *pseudostramineum* Ren. l. c.
Hypnum pseudostramineum C. Muell., Bot. Zeit. 1855: 500.

Plants in soft loose delicate masses, green above, brown below; stems 5–10 cm. long, mostly erect, sparingly and irregularly branching; leaves rather distant, *stem leaves broadly lanceolate, narrowed and slightly decurrent at base, erect-spreading, not secund,* gradually acuminate, *narrowly obtuse, entire;* median stem leaves about 2 × 0.7 mm.; costa extending beyond the middle of leaf; median leaf cells about 7 μ wide, 8–12: 1; apical much shorter; basal gradually shorter and broader; a considerable group of alar cells enlarged and moderately inflated, subhyaline; perichaetial leaves subsheathing, broadly ovate, gradually narrowed into a long acute subreflexed acumen, entire; costa faint. Seta reaching 5 cm.

Type locality Haale am Saale, C. Mueller.

ILLUSTRATIONS.—Proc. Wash. Acad. Sci. **4**: *pl. 23;* Bryologist **4**: *pl. 7. figs 1a–d; Pl. 21, figs. 1a–b.*

Plants described from an "original" specimen from type locality collected by Mueller and sent to the author by Renauld.

Brotherus, Warnstorf and Monkemeyer regard this and allied forms as a variety or form of *Drepanocladus fluitans,* but if this view be correct, the erect nonsecund entire leaves with blunt apex will make it difficult for any one except an expert to identify these forms. Plants closely matching the type have been collected by Waghorne at Fox Cove, Labrador. Most American forms seem to belong to the variety *plesistramineum* (Ren.)

Var. PLESISTRAMINEUM (Ren.) **n. comb.**

Hypnum plesistramineum Ren. l. c.
Calliergidium plesistramineum (Ren.) Grout, l. c.

Leaves closer together, more closely imbricated, broader, often triangular-ovate; costa thicker, leaf cells more flexuose.

Type from Yukon River, Dahl. The cotype in U. S. National Museum has been studied.

ILLUSTRATIONS.—In same plates as typical form; *Pl. 21, figs. 2a–f.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 282, as *Amblystegium vacillans,* from Mt. Mansfield, Vt.

A form from Kotzebue Sound, northwest coast of Alaska, is more robust, darker green; stems reaching 8 cm.; stem leaves reaching 1 mm. wide; enlarged alar cells more numerous and more abruptly inflated. The alar cells of this form, found in the Mitten Herbarium at the New York Botanical Garden, remind one of those of *Brachythecium rivulare* and if the leaves were serrate and acute they would be indistinguishable from forms of that species. This appears to be identical with var. *japonicum* Ren. mscr. from Hakkoda Japan, coll. Rev. Faurie, comm. Ren.

Var. HOVEYI **n. Var.**

Leaves appressed imbricate; stem leaves oblong-lanceolate and gradually acuminate to *ovate-lanceolate and rather abruptly acuminate,* narrowly obtuse, *scarcely decurrent, somewhat narrowed to the insertion,* entire, 1.6–1.8 × 0.36 mm.; median leaf cells narrowly oblong-linear, acute at ends, varying greatly in length, usually about 8 μ wide by 35–50 μ long, occasionally reaching 90 μ in length; apical shorter; basal gradually somewhat shorter and broader; *alar subquadrate.* Differs from *C. pseudostramineum* in differently shaped leaves without decurrent inflated auricles and with wider leaf cells. *Pl. 17A, 15 & 16.*

Type locality, Greenland, Hovey. Type in herb. New York Botanical Garden as *Hypnum pseudostramineum.*

2. CALLIERGIDIUM BAKERI (Ren.) Grout, l. c.

Hypnum (*Calliergidium*) *Bakeri* Ren. Bryologist, l. c.

Tufts very lax and apparently floating, pale green, reddish or brown below; stems slender, without radicles, 8–10 cm. long, sparingly branched; leaves distant, spreading in all directions, the upper rolled

up into an oblong bud, *median broadly ovate, abruptly narrowed to a short obtuse acumination, more rarely subapiculate, subcucullate by the inflexed apex*, rarely more slenderly acuminate, all more or less rounded and *contracted to the indistinctly decurrent base*, occasionally plicate, entire, 1.5–2 mm. long; costa extending from ½–¾ the length of the leaf, sometimes forked; median cells *elongated hexagonal to broadly linear, 6–8 × 25–30μ, narrower toward the margin;* apical cells shorter, subrhombic; basal broader and shorter; subquadrate alar cells numerous, somewhat enlarged, not forming auricles. Sporophyte unknown.

Type locality, Deer Lake, Polk Co., Wisconsin, in a sphagnum swamp, C. F. Baker, Nov. 1897. This was sent out in Baker's exchanges as *Hypnum arcticum* before Renauld described it as a new species.

Described from R. & C. Musc. Am. Sept. Exsic. 397 at New York Botanical Gardens. This number is evidently of the type collection.

Illustrations.—Bryologist, l. c., *pl. 8; Pl. 21, figs. 3a–f.*

This species has a slight resemblance to slender *Calliergon cordifolium*. It differs in the form of the leaves, the shorter costa and the much smaller leaf cells as well as the scarcely inflated alar cells.

11. CALLIERGONELLA Loeske, Hedwigia **50**: 248. 1911 (emend.)

Plants in rather loose mats or tufts, green to reddish-brown, glossy, branching, *more or less regularly pinnate*, but scarcely in one plane; *central strand present but leaves ecostate or with costa short and double.* Stem leaves loosely appressed to erect-open, *scariose, broad, obtuse* and *rounded at apex*, often cucullate with upper margins inrolled; median leaf cells linear-flexuose; alar differentiated, enlarged, in some cases inflated and hyaline. This genus differs from *Calliergon* chiefly in the nearly ecostate leaves. *Acrocladium* Mitt. Journ. Linn. Soc. **12**: 531. 1869, is used for the subtropical species to which it was originally applied in part.

I have included in this genus *Hypnum Schreberi* Willd., which has been so variously placed by recent authors. Its leaf structure is much nearer this group than *Hylocomium* and its perfectly characteristic hypnoid capsules, curved and cernuous with a perfect peristome, make it ridiculous to place it in the Entodonteae as is done in the second edition of Engler & Prantl. Not only the Bry. Eur. but also that most competent bryologist Mr. H. N. Dixon recognizes the affinity between *Hypnum Schreberi* and the *Calliergon* group. Type species, *C. cuspidatum.*

Key.

1. Alar cells abruptly inflated, thin-walled and usually hyaline, forming decurrent auricles..... *cuspidata.*
   Alar cells somewhat enlarged but not thin-walled nor forming auricles..... *Schreberi.*

1. Calliergonella cuspidata (L., Brid.) Loeske, l. c.

Hypnum cuspidatum L. Sp. Pl. 1127. 1753.
Hypnum stereodon cuspidatus Brid. Bryol. Univ. **2**: 562. 1827.
Acrocladium cuspidatum Lindb. Musc. Scand. 59. 1879.
Calliergon cuspidatum Kindb. Eur. & N. Am. Bryin. 81. 1896.

Plants in deep loose masses, yellowish-green to brown below, often glossy; stems 8–15 cm. in length, erect to ascending, with irregularly pinnate branching; stems and *branches cuspidate at the tips by the convolute-appressed terminal leaves; outer layer of stem cells large, thin-walled and hyaline;* stem leaves loosely imbricate to erect-open, somewhat narrowed and decurrent at base, crowded, 1.5–2 mm. by a little less than half as wide, occasionally 2–5 × 1.2 mm., widely elliptic-oblong to ovate-oblong, entire, at apex *broad, rounded and obtuse*, rarely with a short apiculus, concave and cucullate with the upper margins inflexed, ecostate or with costa short and double; branch leaves smaller and proportionally narrower; median leaf cells narrowly linear-flexuose, about 6 μ wide and 10–15 : 1; marginal narrower, apical shorter; basal shorter, broader and incrassate; *alar suddenly enlarged, inflated and thin-walled, forming conspicuous decurrent auricles.* Dioicous; seta 4–7 cm. long; capsule 3.5–4.5 × 1–1.6 mm., subcylindric, arcuate and cernuous, somewhat wrinkled when dry; operculum conic-apiculate; annulus of 3–4 rows of cells; peristome perfect. Spores in late spring or early summer. Type European.

Illustrations.—Bry. Eur. *pl. 619;* Limpricht, Laubm. **3**: 568. *f. 434;* Jennings, Mosses of W. Pa. *pl. 40;* M. H. M. 321, f. 167.

Exsiccati.—Sull. Musc. Allegh. 32; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 307, (Ed. 2) 454; Aust. Musc. Appal. 444; Grout, N. Am. Musc. Pl. 90, 100 & 353; Allen, Mosses Cascade Mts. 128; Macoun, Can. Musc. 385.

In cool bogs and among grasses and other mosses in wet places, northern U. S. and Canada across the continent, south to northern New Jersey, Pennsylvania and Iowa.

2. CALLIERGONELLA SCHREBERI (Willd., Br. & Sch.) Grout, **n. comb.**

Hypnum Schreberi Willd. Prodr. Fl. Berol. 325. 1787, and Br. & Sch. Bry. Eur. fasc. 57–61, *pl. 620.* 1854.
Hypnum parietinum L. Flor. Suec. (Ed. 2) no. 1200. 1755.
Pleurozium Schreberi Mitt. Journ. Linn. Soc. **12:** 537. 1869.

Plants bright to pale yellow-green, shining, in large loose mats or tufts; stems 10–15 cm. long, *red, stiff and erect* from a somewhat prostrate base, *typically with rather closely pinnate but somewhat irregular branching*, sometimes slender and little-branched, or again robust with the branches clustered at the top of the stem; *branches terete, julaceous and often tapering;* outer stem cells not enlarged; stem leaves reaching 2.4 × 1.5 mm., often smaller, rather loosely imbricate, lightly plicate when dry, entire or crenulate serrate *at the obtuse rounded apex*, widely oblong-ovate or elliptic, *concave, with the margins strongly infolded near the apex* and more or less reflexed near the base; costa faint and double or lacking; median leaf cells linear-flexuose, 7 μ wide, 8–15 : 1; apical shorter, marginal narrower; basal shorter and broader, incrassate and porose, often colored; *angular cells forming a triangular patch of enlarged, somewhat inflated subrectangular cells that are usually colored* and subopaque; branch leaves similar but smaller and proportionally narrower. Dioicous; seta reddish; capsule about 2.5 mm. long, chestnut, subcylindric, arcuate and cernuous; annulus lacking. Spores in autumn.

Type European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Jennings, Mosses of Western Pa. *pl. 44;* M. H. M. *figs. 165 & 166.*
EXSICCATI.—Drumm. Musc. Am. 208; Sull. Musc. Allegh. 33; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 308 & 308b, (Ed. 2) 455 & 456; Aust. Musc. Appal. 445; Grout, N. Am. Musc. Pl. 45, 45a & 479, Musci Perfecti 35; Allen, Mosses Cascade Mts. 129.

Common in moist shaded places, sometimes in swamps, again in places relatively dry for a portion of the year; northern U. S. and Canada across the continent, south to Virginia in the mountains.

Var. TANANAE Grout.

Calliergon tananae Grout, Pub. Puget Sd. Biol. Sta. 3^{58}: 58. 1921.

Stems *very slender and sparingly branched;* stem leaves closely appressed-imbricate, *shorter and proportionally broader*, rounded and broadly obtuse at apex *with the apical margins slightly or not at all infolded.*

Type from Tanana, Alaska, O. D. Clark. Type in herb. A. J. Grout.

Another collection by the same collector at the same date and in the same general locality is very similar except that the plants have the typical pinnate branching. This variety seems to be an exceptionally slender arctic form.

12. DREPANOCLADUS (C. Muell.) Roth, Hedwigia **38:** Beibl. 6. 1899.

C. Muell. Syn. **2:** 321. 1851 as a subgenus. *Harpidium* Sulliv. Mosses of the U. S. 73. 1856, as a subgenus.

Plants slender to very robust, without paraphyllia (there are a few inconspicuous pseudoparaphyllia in *D. uncinatus*). Leaves usually falcate-secund to circinate, often forming conspicuous hooks at the ends of the stem and branches, not papillose, nearly always longly and slenderly acuminate; costa single and well developed, usually reaching well into the upper ⅓ of the leaf; leaf cells very long and narrowly linear (shorter in forms of *aduncus*); alar cells in most species enlarged and inflated, forming more or less conspicuous decurrent auricles; basal cells usually shorter and thicker-walled, often porose. Capsules inclined to horizontal, subcylindric and curved, usually somewhat contracted under the mouth when dry, with a perfect hypnaceous peristome.

Type species *D. aduncus* (Hedw.) Moenkem. (Not *Hypnum aduncum* L.)

Of all the mosses this genus is probably the most difficult because of the extreme variability of the plants. Even the recognized authorities in the group identify many specimens by telling what they are nearest rather than by referring them definitely to a described form. Nearly all grow in water or very wet places and the amount of water and other conditions of their immediate environment appear to modify their growth profoundly. Sometimes two well marked varieties can be found on the same plant. So variable are the leaves that it is absolutely necessary to take fully developed leaves from the older portions of the stem for purposes of study and comparison. In removing these, great care must be taken to get all of the leaf as the characteristic swollen alar cells often remain attached to the stems.

Although the species are so difficult to define and identify, the genus itself is one of the easiest to recognize. *Scorpidium scorpioides* looks exactly like a large species of this genus but its short and double costa at once differentiates it. *Cratoneuron* species are often mistaken for species of this genus, but their abundant paraphyllia are very easy to observe and at once distinguish them from *Drepanocladus.*

D. aduncus, D. fluitans and their subspecies have forms with straight erect, often obtuse leaves that are very puzzling.

Drepanocladus, meaning sickle-branch, must replace the more familiar and less cumbersome *Harpidium* because *Harpidium* had previously been used for another genus of plants.

The studies of the late Captain Renauld and the later work of Moenkemeyer have been freely consulted and drawn upon and my work has been greatly aided by numerous specimens identified by them and sent me for comparison when the treatment of this genus was in preparation for "Mosses with Hand-lens and Microscope."

Loeske (Hedwigia 46: 309. 1907) has divided this genus into several genera which are better regarded as sections or subgenera, and to these Brotherus has added *Pseudodrepanocladus* for the *Hypnum badium* of Hartman.

I. *Sanionia.* Autoicous. Stems with central strand; pseudoparaphyllia present at the origin of branches; leaves mostly circinnate, deeply plicate with many folds, distantly and finely denticulate; leaf cells very narrow, at the basal angles a few hyaline and thin-walled cells form a distinct small group but not decurrent auricles; inner perichaetial leaves plicate, sharply serrate above; annulus present.

Includes *D. uncinatus.*

II. *Limprichtia.* No pseudoparaphyllia; central strand small or lacking; leaves secund, falcate (except forms of *D. revolvens*); leaf cells very narrow; inner perichaetial leaves plicate, entire; annulus present. *D. vernicosus; D. revolvens, D. intermedius.*

III. *Warnstorfia.* Stems with central strand; no pseudoparaphyllia; leaves not plicate, more or less serrulate; alar cells inflated and hyaline, usually forming sharply defined decurrent auricles; inner perichaetial leaves not plicate; annulus lacking.

D. fluitans, D. Berggrenii, D. exannulatus.

IV. *Pseudodrepanocladus.* Dioicous. Stem with central strand; no pseudoparaphyllia; leaves not plicate, secund and more or less falcate, not decurrent, entire; all leaf cells unusually thick-walled; alar cells a rather distinct group of subquadrate incrassate porose cells that often remain attached when the leaves are removed; inner perichaetial leaves plicate, entire; annulus present; peristome teeth without the usual transverse striae. *D. badius* only.

V. *Drepanocladus* proper. Dioicous. Central strand present; leaves entire; alar cells usually inflated and distinct; inner perichaetial leaves plicate, entire; annulus present. *D. aduncus, D. Sendtneri, D. lycopodioides, D. brevifolius.*

Key.

1.	Leaves plicate, often strongly so	2.
	Leaves not plicate, or only slightly so in *revolvens* and *lycopodioides;* central strand present in all species* (lacking in *D. revolvens miquelonensis*)	3.
2.	Leaves without enlarged or inflated alar cells; stems without central strand and with small thick-walled cuticular cells	*2. vernicosus.*
	Leaves with a few larger but scarcely inflated alar cells; central strand present; outer layer of stem cells larger and thinner-walled than those underneath	*1. uncinatus.*
3.	Leaves with only two to three inflated alar cells, often none	4.
	Leaves with enlarged and often inflated angular cells usually forming conspicuous auricles	7.
4.	Stems with a layer of larger outer cells	5.
	Outer layer of stem cells not enlarged	6.
5.	Robust, reddish; leaves with a very long slender acumination	*3. revolvens.*
	More slender, yellowish to green, brown below; acumination much shorter	*4. intermedius.*
6.	Plants very large, 10–30 cm. long; leaves 3–6 mm. long	*6. lycopodioides.*
	Plants not over 4 cm. long; leaves ±1.5 mm. long	11.
7.	Leaves entire; annulus present	8.
	Some or all of the leaves serrulate, especially at the apex; annulus lacking	10.
8.	Alar cells exceedingly thick-walled and porose	*5. badius.*
	Alar cells thin-walled or moderately thickened, rarely, if ever, porose	9.

*D. *lycopodioides* and *D. Sendteri Wilsoni* f. *giganteus* have leaves that are more or less rugose and often slightly plicate. Leaves of some *fluitans* or *exannulatus* forms are very slightly plicate.

9. Costa stout; enlarged auricular cells not reaching the costa, their cell walls usually somewhat thickened and colored when old ..... *9. Sendtneri.*
   Costa more slender; enlarged and inflated auricular cells often reaching the costa, not thickened and rarely much colored ..... *8. aduncus.*
10. Costa stout, usually reaching well into the acumination; decurrent auricles large, made up of large inflated and usually elongated cells, usually reaching the costa ..... *11. exannulatus.*
    Costa more slender and usually shorter; inflated alar cells much less sharply differentiated, not reaching the costa and often not forming distinct auricles ..... *10. fluitans.*
11. Lower leaf cells strongly porose** ..... *7. brevifolius.*
    Lower leaf cells not porose ..... *12. Berggrenii.*

1. DREPANOCLADUS UNCINATUS (Hedw.) Warnst. Beih. Bot. Centralbl. **13**: 417. 1903.

Hypnum uncinatum Hedw. Musc. Frond. **4**: 65, *pl. 25.* 1797, and Sp. Musc. 289. 1801.
Hypnum Moseri Kindb. Ottawa Nat. **4**: 65. 1890.

Plants in wide thin intertangled mats, pale to golden green, sometimes brown below but *without any tinge of red or purple;* stems procumbent and often intertangled with other mosses, sometimes crowded and suberect, 2–10 cm. long, rather distantly and irregularly branched as a rule, but often more or less regularly pinnate; central strand present, outer layer of stem cells larger and thin-walled; stems and branches hooked at the end by the falcate-secund leaves; *pseudoparaphyllia present in the axils of the branches;* leaves rather close, *strongly falcate-secund to circinnate, strongly plicate with numerous plicae whether wet or dry, narrowly elongated-lanceolate,* 3.5–5 × 0.75–1 mm., slightly rounded and narrowed to the insertion, usually somewhat decurrent, *gradually tapering to a very long and slender acumination which is usually strongly denticulate with rather distant teeth,* rarely nearly entire; costa extending well into the acumination; median leaf cells linear-flexuose, 5 μ wide, 12–20 : 1; basal somewhat shorter and thicker-walled; cells at basal angles varying greatly, *usually a few somewhat enlarged,* hyaline and decurrent but not forming noticeable auricles; above these larger cells a few smaller quadrate cells; *perichaetial leaves very long and sheathing,* the inner 5–8 mm. long with an exceedingly long capillary acumination, plicate, costate, serrate above. Monoicous; seta 2–3 cm. long; capsule cylindric, arcuate, 2.5–3.5 × 0.75 mm., slightly contracted under the mouth when dry and empty; operculum conic with a large sharp apiculus, almost rostrate; annulus of three rows of cells; peristome perfect. Spores in spring (to early summer in the far north).

Type locality European.

ILLUSTRATIONS.—Bry. Eur. *pl. 600;* M. H. M. *pl. 72.*

EXSICCATI.—Drumm. Musc. Am. 202; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 313, (Ed. 2) 463; Sull. Musc. Allegh. 24; Aust. Musc. Appal. 412; Grout, N. Am. Musc. Pl. 106, 107, and 366; Allen, Mosses Cascade Mts. 132; R. & C. Musc. Am. Sept. Exsic. 134.

On earth, trees and stones in moist places but rarely, if ever, submerged except at high water; growing intertangled with many different species of mosses of which various species of *Brachythecium, Calliergon stramineum, Dicranum Bonjeani* and *Oncophorus virens* are a few.

Found chiefly in cool shaded places in hills and mountains, northern U. S. and Canada across the continent, north to the arctic, south to the Gulf States according to Jennings but rare south of Pennsylvania in the East, Ohio, Colorado, Utah, N. Mexico and California. Very common where found and occurring in a great number of forms, of which only a portion of those that have been named are described here.

Forma AURICULATUS Moenkem. has inflated alar cells numerous, forming auricles. Glacier National Park, Montana, alt. about 5000 ft.

Var. SYMMETRICUS (R. & C.) Grout, Check List, 16. 1929.

Hypnum symmetricum R. & C. Bot. Gaz. **14**: 99. 1889. Distinguished chiefly by the erect capsules, which are narrow and practically symmetric in typical plants. The type was described as having leaves less strongly and regularly plicate, entire or slightly denticulate; capsules sometimes two from the same perichaetium. Type from Oregon.

Forms with capsules erect and symmetric or nearly so are not rare in the northwestern U. S. from the Rocky Mts. westward and probably in adjacent Canada, but the leaf characters described for the type are not always correlated. Grout, N. Am. Musc. Pl. 207 has capsules nearly erect and symmetric. A specimen from Grand Gulf, Mt. Washington, N. Hampshire, is also referable to this variety.

** *D. badius* may be sought here.

Var. PLUMULOSUS (Br. & Sch.) Roth, Europ. Laubm. **2**: 551. 1905.

Hypnum uncinatum plumulosum Br. & Sch. l. c. *figs. v 1 & 2.*

Very slender and closely pinnate; leaves 2.4 × 0.6 mm., having shorter acumination and fewer plicae, less denticulate, sometimes nearly entire; seta shorter and capsule smaller. Probably throughout the range of the species. Grout, N. Am. Musc. Pl. 195.

Apparently a habitat form growing on bark of trees and rocks in shaded elevated regions.

Var. *plumosus* (Schimp.) Ren. is a similar form but larger; leaves with a long slender capillary acumination. Less frequent than var. *plumulosus* and of little importance. Grout, N. Am. Musc. Pl. 101.

Var. *polaris* (Ren.) as represented in the type from St. Matthew's Island, Alaska, is merely a very short (10–15 mm.) stunted arctic-alpine form; leaves smaller, less plicate and less serrate; leaf cells with thicker walls. Type duplicate seen. Also found on Pike's Peak, Colorado, at the summit, 14147 ft. altitude.

There are forms slender, forms robust with leaves less falcate [var. *subjulaceus* (Br. & Sch.) Grout]; forms with leaves entire [var. *fragilis* (Aust.)]; leaves less plicate as in var. *plumulosus;* also forms with varying lengths of seta and capsule but in nearly every case there are enough of the italicised characters present in some plants of a tuft to make identification with the species fairly easy and certain. This last, it seems to the author, is the function of a manual and not the niceties of varietal description appropriate to an extensive monograph.

2. DREPANOCLADUS VERNICOSUS (Lindb.) Warnst. Beih. Bot. Centralbl. **13**: 397. 1903.

Hypnum vernicosum Lindb., Hartm. Skand. Fl. (Ed. 8) 17. 1861.

In deep intertangled tufts, yellow-green above, brown to reddish below; stems *rather slender*, ascending to erect, hooked at the ends with the falcate-secund leaves, 5–15 cm. long; branching subpinnate, at times distantly but almost regularly pinnate; *central strand lacking; outer layer of stem cells small and thick-walled; stem leaves neither decurrent nor auricled, plicate,* close, falcate-secund to circinate, lanceolate to ovate-lanceolate, often channelled at apex, ± 2.5 mm. long, 0.9–1.2 mm. broad, *gradually and rather broadly acuminate, entire;* costa extending beyond the middle of leaf; median leaf cells very narrow and flexuose, 5–6 μ long, 8–15 : 1; a *row or two or more of basal cells shorter, broader thick-walled and colored, not different at basal angles;* inner perichaetial leaves erect, sharply acuminate, plicate, with a long costa. Dioicous; capsules ovoid-cylindric, red-brown, cernuous, unsymmetric, 2.5–3 × 1.2–1.5 mm., strongly contracted under the mouth when dry; operculum conic-apiculate; annulus of 3 rows of cells, deciduous; peristome perfect. Spores infrequent, ripening in spring. Type locality European.

In swamps and wet places, northern U. S. and Canada, south to New Jersey, Pennsylvania and Ohio. Not common. Difficult at times to distinguish from *D. intermedius* without stem sections.

ILLUSTRATIONS.—Limpricht, Laubm. **3**: 375. *fig. 407;* Dixon & Jam. Handb. Brit. Mosses, *pl. 58E;* M. H. M. *f. 160* and *pl. 71.*

EXSICCATI.—Aust. Musc. Appal. 402; Allen, Mosses Cascade Mts. 134; Macoun Can. Musci. 384 in part (one specimen at the N. Y. Bot. Garden is *Cratoneuron falcatum*); Grout, N. Am. Musc. Pl. 391, 391a.

Very robust dark colored forms (often with a reddish tinge), with leaves less falcate, 3–4 mm. long are known as var. *major* (Lindb.) Warnst. = var. *turgidus* (Jur.) Moenkem.

3. DREPANOCLADUS REVOLVENS (Sw., C. Muell.) Warnst. Beih. Bot. Centralbl. **13**. 402. 1903.

Hypnum revolvens Sw. Musc. Suec. 101, *pl. 7, f. 14.* 1799 and C. Muell. Syn. **2**: 323. 1851 (not including synonyms).

Plants in deep soft tufts, *deep red-purple to reddish black,* variegated above with golden-green and orange; stems irregularly divided, unequally and not pinnately branched; stem section showing a *small central strand and a single cuticular layer of larger hyaline cells;* leaves large, 3–5 × 0.6–1 mm., densely crowded so that stems appear robust and tumid, not decurrent, *strongly and regularly circinate,* slightly or not at all plicate, longly and slenderly acuminate, widely oblong to lanceolate at base, entire or serrulate near apex, concave, canaliculate above; costa reaching ¾ the length of the leaf; *leaf cells very long and narrowly linear-flexuose,* about 6 μ wide, 10–30 : 1, or even longer according to Dixon, narrower towards the margin, uniform almost to the base; a few basal cells, about two rows, broader, shorter, thicker-walled, porose, and deeply colored, *not different or decurrent at the angles,* or with a few (1–4) somewhat inflated and hyaline. Autoicous or dioicous; seta 2–5 cm. long; capsule oblong-ovoid, unsymmetric, cernuous, 3–3.5 mm. long, about 3 : 1; operculum conic-apiculate; annulus of two or three rows of cells; peristome perfect. Spores in spring; rarely produced.

Type locality Switzerland.

ILLUSTRATIONS.—Bry. Eur. *pl. 601;* Dixon & Jam. Handb. Brit. Mosses, *pl. 58F. Pl. 28.*
EXSICCATI.—Grout, N. Am. Musc. Pl. 97 and 159 (as *Hypnum capillifolium*).
In swamps, western U. S. and western Canada in the Rocky Mountain region from Colorado to Alaska and west to Vancouver Id. Rare.

Var. *Cossoni* (Schimp.) Ren. is a very robust form but otherwise scarcely distinguishable from typical *revolvens*. It varies greatly in size, sometimes almost as robust as *Scorpidium*, at others approaching *D. intermedius*. The form *Cossoni* occurs with the other forms in N. America but most recent authors do not think it worthy of even varietal rank.

Var. MIQUELONENSIS (Ren.) **n. comb.**

Hypnum scorpioides miquelonense Ren. in R. & C. Musc. Am. Sept. Exsic. 131.

Plants green at the tips, *dark brownish-purple below; outer layer of stem cells enlarged;* leaves strongly falcate-secund, oblong-lanceolate, subtubulose above, widest near the middle; costa very slender and faint, reaching ½ the length of the leaf; leaf cells *exceedingly long and narrow, thick-walled*, the cell walls nearly as wide as the cell cavity. *Pl. 26E, 4–6.*

The above description applies to the leaves of the ultimate branches and seems to indicate clearly that this plant belongs here rather than with *Scorpidium* or *D. lycopodioides*. Renauld (Husnot, Musc. Gall., 394) says "A robust submerged form; . . . Stems 15–25 cm. long. Leaves of the principal branches subimbricate, somewhat secund, obtusely acuminate." He also states that the costa may be short and forked. Collected on the island of Miquelon by Dr. Delamare in a mixture of "*Hypnum scorpioides* and *lycopodioides*."

*4. DREPANOCLADUS INTERMEDIUS (Lindb.) Warnst. l. c.

Hypnum intermedium Lindb. Hartm. Skand. Fl. (Ed. 9) 17. 1864.

Subspecies of the last, often considered merely a variety. Differs from *D. revolvens* in the more slender stems and usually pale yellowish, or green color, often brownish below; leaves ± 2 mm. long, not at all plicate, much more shortly acuminate, shaped much like those of *D. vernicosus;* leaf cells shorter, not so incrassate or colored at base; stem section as in *D. revolvens*. Dioicous.

ILLUSTRATIONS.—Dixon & Jam. Handb. Brit. Mosses, *pl. 58;* M. H. M. *f. 161*, p. 307.
EXSICCATI.—Grout, N. Am. Musc. Pl. 305; Sull. Musc. Allegh. 25 (as *Hypnum aduncum* var.).; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 314.
Bogs, Northern U. S. and Canada across the continent. Rare. Moxley collects in Bruce Co., Ontario, an interesting form with the leaf apex rather suddenly contracted to a short (0.2 mm.) filiform acumination.

5. DREPANOCLADUS BADIUS (Hartm.) Roth, Europ. Laubm. **2**: 569. 1905.

Hypnum badium Hartm. Skand. Fl. (Ed. 5) 332. 1849.

Plants rather rigid, in loose deep tufts, *green to copper-colored above, dark red-brown to almost black* below; stems prostrate to erect, sparingly divided to branched, reaching 6 cm. or more in length; stem leaves rather close, broadly ovate, gradually narrowed to a rather slender acumination (sometimes rather abruptly narrowed to shorter acumination), *narrowed at base but not rounded or decurrent, very concave*, loosely imbricate and somewhat falcate-secund, entire, 1.2–1.5 × 0.6–0.75 mm.; costa reaching ¾ the length of the leaf, often forking above; *median leaf cells* 7 μ wide, 6–10 : 1, *linear-flexuose, very thick-walled, porose; leaf cells becoming broader, shorter, thicker-walled, more porose and darker copper-colored at base; at basal angles a small group of still larger cells with still thicker walls*, part or all of which often remains attached to the stem upon removal of the leaf. Dioicous; capsules red-brown, 1.5–2 mm. long, somewhat contracted under the mouth when dry; operculum conic-apiculate to subrostrate. Type Scandinavian. Rare and subarctic. The American forms from Labrador, Allen, and the Yukon, Williams, have much larger leaves, reaching 2.2 × 0.85 mm., much more abruptly narrowed to a rather short slender acumination.

The European authors that speak of the Greenland plants do not note this difference.

ILLUSTRATIONS.—Roth, l. c. *pl. 59;* Broth. Laubm. Fennosk. *f. 92; Pl. 24E, 1–2.*

6. DREPANOCLADUS LYCOPODIOIDES (Brid.) Warnst. Beih. Bot. Centralbl. **13**: 400. 1903.

Hypnum lycopodioides Brid. Sp. Musc. **2**: 227. 1812. emend. Schwaegr. Suppl. **1²**: 300. 1816.

Very robust, resembling Scorpidium in the tumid stems with large rugose leaves, "of a rich golden color" (Dixon); stems simple or with few short branches, 10–30 cm. long; leaves usually crowded, *very large*, *3–6* × 1.3–1.6 mm., very concave, falcate-secund, ovate-lanceolate to oblong-lanceolate, entire or rarely slightly denticulate above, tapering to a slender acumination of moderate length, *narrowed and rounded*

and very slightly decurrent at the wide broadly excavate base, when dry irregularly rugose and slightly plicate; costa narrow, 30–50 μ wide, reaching to the base of the acumination; median leaf cells linear, about 7 μ wide, 8–15 : 1; basal cells shorter, broader, *thick-walled and porose; angular cells scarcely wider, rectangular to quadrate.* Dioicous; seta 2–4 cm. long; capsules subcylindric and curved, 3.5 × 0.9 mm.; operculum conic-apiculate; annulus of 3 rows of cells; peristome perfect. Spores in May.

Type locality European. Deep bogs and pools.

ILLUSTRATIONS.—Bry. Eur. *pl. 613 and 614:* Dixon & Jam. Handb. Brit. Mosses, *pl. 58A; Pl. 26A.*

Known from our region from Greenland and Miquelon Island only. A very striking species distinguished from *Wilsoni* by the more crowded leaves, which are plicate-rugose when dry, the much smaller, non-inflated alar cells, and costa narrower as a rule.

Var. BREVIFOLIUS (Berggren) C. Jensen, Meddel. om Groenl. **3**: 322. 1887.

"Leaves short, slightly secund, broadly ovate, concave, smooth or lightly sulcate, more or less suddenly narrowed into the apex, which has inrolled margins." Greenland. Original description quoted. Apparently the same as the next species.

7. DREPANOCLADUS BREVIFOLIUS (Lindb.) Warnst. l. c. 416. 1903.

Hypnum brevifolium Lindb. Spitsb. Mossor 541. 1866.

Tufts golden yellow above, brown below; stem leaves from a narrower base broadly ovate to ovate-lanceolate, gradually short-acuminate 1.6–1.8 × 0.8–0.9 mm., falcate-secund, concave and subtubulose above by the infolded entire margins, not plicate; costa various, even on the same plant, always thin, sometimes faint, sometimes double and forking, sometimes single and longer and reaching nearly or quite to the middle of the leaf; median leaf cells comparatively short, 6–8 μ wide, occasionally reaching 60 μ in length but usually shorter; cells at base broader and shorter, 2–3 : 1, thick-walled and often colored at the insertion; at basal angles a group of small quadrate cells and *occasionally* below these a row or two of slightly enlarged cells at the insertion. Sporophyte unknown. Type from Spitzbergen. *Pl. 24E, figs. 4–6.*

Fort Conger, N. Greenland by the Peary expedition in 1902, associated with *D. revolvens*, determined by Nils Bryhn; Baxter Island, arctic coast of Alaska, collected by the Canadian Arctic expedition in 1918.

Specimens of both American collections have been seen at the N. Y. Botanical Garden; also N. W. Greenland, Fram Expedition.

Moenkemeyer states (Laubm. Europ. 769) that all the plants he possesses "Under the names *Hypnum brevifolium* Lindb., *latinerve* Arn., *latifolium* Lindb. et Arn. from Siberia, Spitzbergen and Arctic America—belong to this variety (i. e. *D. lycopoioides brevifolius*) or to *D. Sendtneri* and *Scorpidium scorpioides.*"

The variable costa, often short and double, and the shorter and broader leaf cells seem to the author to indicate that the specimens studied are worthy of specific rank.

8. DREPANOCLADUS ADUNCUS (Hedw.) Warnst. Beih. Bot. Centralbl. **13**: 400. 1903.

Hypnum aduncum Hedw. Musc. Frond. **4**: 62. *pl. 24.* 1797 and Sp. Musc. 295. 1801.

Plants dark to yellowish green, brownish below, growing in soft loosely intertangled mats, or in some forms in rather dense tufts with slender upright secondary stems, in still other forms loosely floating; stems 2–3 cm. long in f. *tenuis*, to 30–40 cm. in f. *paternus*, irregularly to pinnately branching; stem leaves broadly triangular-ovate and acute to slenderly acuminate, or long-lanceolate and filiform-acuminate in aquatic forms, usually somewhat secund, especially at the ends of the stems and branches, often strongly falcate, *entire, strongly excavate at base with large decurrent auricles of enlarged and strongly inflated cells*, which are usually hyaline and may reach to the costa; median leaf cells linear-flexuose in most forms to oblong-hexagonal in var. *polycarpus;* leaf cells usually longer toward the apex and shorter towards the base; costa usually of medium size, extending to about the middle of the leaf, but short to double in f. *tenuis* and strong and excurrent in f. *capillifolius;* branch leaves smaller and often of shapes quite different from those of the stem, more often falcate and less often long-lanceolate; perichaetial leaves large, long-acuminate, slightly plicate, with a long slender costa. Dioicous; seta about 2.5 cm. long; capsule oblong, 2–2.5 mm. long, curved and cernuous; operculum conic-apiculate, annulus present; peristome perfect. Spores in summer.

Widely distributed throughout North America, especially in the northern two-thirds.

Captain Renauld says in Husnot, Musc. Gall. 369, "The variations of *Hypnum aduncum* are due both to climatic and geologic conditions," and suggests that in France the more slender typical forms are found in siliceous soils and the more robust *Kneiffii* and *polycarpus* forms on calcareous and clayey substrata. Accordingly collectors should note the type of soil on which these plants are found, especially as to its acidity or alkalinity.

D. aduncus has a series of forms paralleling those of *D. Sendtneri.* For the distinctions see under the latter species. *D. aduncus* is distinguished from *D. fluitans* by its broader entire leaves and in many forms by its broader and shorter leaf cells.

Not only is this species infinitely variable as to the structure and form of individual plants but leaves on the same stem may vary from long and slenderly lanceolate with narrowly linear cells to broadly ovate with broadly oblong-hexagonal cells. One plant had the broad short leaves at the top and bottom of the stem with the long and narrow leaves between. The lower leaves were probably the first leaves of the young stem, the middle leaves grew on a submerged portion, and the upper leaves on the emergent portion.

In general, as Schimper observes in his comments on *D. aduncus* in the supplement to the Bryologia Europea, the lower leaves of stem divisions and branches are broader and more cordate in outline than those elsewhere and have a shorter areolation. In other words the lower leaves of all forms are of the *polycarpus* type.

To attempt to describe all the numerous forms that have been given names would be out of place in a work of this nature but an attempt is made to describe the principal forms and to indicate their relationships.

In the descriptions and classification of this most polymorphous species the main object has been to make an intelligible arrangement of the forms and to give descriptions enabling the student to recognize the principal forms likely to be found. All manner of intergrading and intermediate forms occur which may be referred to one or the other of two related described forms without committing any taxonomic sin or stultifying the reputation of the student identifying the plant. Many specimens will best be classified as "approaching" or "near" the nearest described form.

The second objective has been to correlate the arrangement and the names used with previous literature. This has not been easy or certain as authors differ in the application of some of the names used. In the main the arrangement is that of Moenkemeyer in the "Laubmoose Europas" and the descriptions in the main are founded on the conceptions of Renauld, except in the case of var. *Kneiffii.**

The main grouping given is based on the structure of well-developed leaves growing entirely out of water. All three of the groups treated below produce *pseudofluitans* forms when submerged and *capillifolius* forms under certain conditions not well understood, and it seems probable that these forms will all be found widely distributed in N. America.

KEY TO VARIETIES.

1. Lower leaf cells linear ..... 2.
   Lower leaf cells oblong-hexagonal ..... var. *polycarpus.*
2. Stem leaves falcate-secund, lanceolate, channelled at apex ..... *aduncus typicus.*
   Stem leaves little if at all falcate or secund except at ends of stem and branches, oblong-lanceolate to ovate-lanceolate, apex flat ..... var. *Kneiffii.*

I. D. ADUNCUS TYPICUS. The form described by Hedwig and described from his type by various authors has leaves that are long and slenderly acuminate from a broadly lanceolate base, *little narrowed to the insertion,* more or less falcate-secund, especially those at the ends of the stems and branches; *apex channelled by the incurved upper leaf margins; median leaf cells narrowly linear;* only those cells near the insertion markedly broader and shorter; costa usually extending to about the leaf middle; inflated alar cells of the auricles numerous, often extending well toward the costa.

ILLUSTRATIONS.—Bry. Eur. *pl. 604,* and Suppl. Hypnum *pl. 1;* Husnot, Musc. Gall. *pl. 105, figs. 4–7;* Moenkem. Laubm. Europ. *f. 171a;* M. H. M. *pl. 74, f. 1; Pl. 24D* and *27Aa–b.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 249 (a lax form), 289 & 326, 433, 433a and 431 (an unusually large form approaching *D. Wilsoni* in appearance but with the alar cells of this species), 454 (approaching f. *aquaticus*).

Forma AQUATICUS (Sanio) Moenkem. A large submerged form; leaves reaching 3–4 mm. in length, distant, long-lanceolate, terminating in a long slender filiform acumination, falcate to twisted; median leaf cells long-linear. *Pl. 27B.* This is a submerged form that still keeps some of the *typicus* characters. Plants with typicus leaves above water also produce *pseudofluitans* submerged leaves. *Typicus* also produces *capillifolius* forms (*Pl. 27A, g*), usually in the submerged portions. N. Am. Musc. Pl. 426.

Forma PSEUDOSENDTNERI Ren. & Langeron has the strong costa and strongly falcate-secund leaves of *Sendtneri* but has a larger group of inflated alar cells and narrower median cells. It seems possible that the differences between *Sendtneri* and *aduncus* are largely brought about by habitat conditions.

*This has been made easier by a large series of specimens sent me by Renauld about 25 years ago when Mosses with Hand-lens and Microscope was being prepared.

II. Var. KNEIFFII (Br. & Sch.) Warnst. l. c.

Amblystegium Kneiffii Br. & Sch. Bry. Eur. fasc. 55–56, *pl. 573*. 1853.

Plants with the habit of *Leptodictyum riparium*, differing from the typical form in the broader leaves with a flat acumen, which is usually much shorter; the leaves are only slightly if at all secund even at the ends of stems and branches, broadly lanceolate to oblong-ovate; median leaf cells narrowly linear, slightly broader and shorter in the lower portion. *Pl. 26F* and *Pl. 27A, c.* N. Am. Musc. Pl. 461 (approaches f. *intermedius*).

Renauld, basing his opinion on plants which he considered the type form, considered var. *Kneiffii* nearer the var. *polycarpus* than the true *aduncus typicus*. Such, however, was not Schimpers conception; he figures the leaves a little shorter and broader than *aduncus*, sometimes slightly secund and occasionally somewhat channelled above; *but* he figures the lower leaf cells as narrowly oblong-linear and states specifically that these cells are narrower than those of *Amblystegium riparium*, with which he associated it in his genus *Amblystegium*.

Schimper in the supplement to the Bry. Eur. says that *Kneiffii* is nothing but a lax, often prostrate form of *aduncus* with leaves distinctly shorter and less regularly falcate.

I have followed Schimper and Moenkemeyer rather than Renauld in the treatment of this variety. The short secund leaves in M. H. M. *pl. 74. f. 44* do not to my mind represent *Kneiffii* but a form of *polycarpus*.

Forma INTERMEDIUS (Br. & Sch.) Moenkem. seems to be a submerged form of *Kneiffii*, differing from *typicus aquaticus* chiefly in the non-falcate, little-contorted leaves with a shorter acumination. Leaves of the *intermedius* form frequently occur on plants bearing other leaves that cannot be distinguished from the *aquaticus* form except that they are not falcate or much twisted. N. Am. Musc. Pl. 216 & 188a. *Pl. 27D* and *27A, d*.

Plants of this form are frequently indistinguishable from *Leptodictyum riparium* except by the inflated auricular cells.

Var. *Kneiffii* also produces submerged *pseudofluitans*, and *capillifolius* forms. N. Am. Musc. Pl. 246. *Pl.* 27A, g.

Forma PUNGENS (H. Muell.) Moenkem. Plants very slender, filiform, little branched, soft and loose (Moenkemeyer), rigid (Dixon); leaves subimbricate, oblong-ovate, apiculate to acuminate, the apical rolled together into a cuspidate point.

It seems probable that *Calliergidium pseudostramineum* and its forms are merely extreme *Kneiffii* forms. Moenkemeyer puts them with D. *fluitans* but the relatively broad entire leaves indicate a closer relationship to this species.

III. Var. POLYCARPUS (Bland.) Warnst. Laubm. Kryptogamenfl. Mark Brand. 1000. 1906.

Hypnum polycarpon Bland. in Sched. Voit. in Sturm. Deutschl. Fl. **2**: Heft 14. 1813.

Tufts bright to brownish green; stems procumbent with numerous slender branches, not pinnate, 5–10 cm. long, longer in submerged forms; leaves rather distant, erect open, typically little falcate or secund (strongly so in some of its forms) except at the ends of stems and branches, broadly ovate to oblong-ovate, subcordate at base, rather shortly acuminate (except forms); branch leaves smaller and often secund; leaf cells, especially in the lower ½ of the leaf much shorter and broader than in *typicus* or *Kneiffii*, oblong-hexagonal to oblong-linear; inflated alar cells usually large and numerous, forming large decurrent auricles; costa usually strong, reaching beyond the middle of the leaf. M. H. M. *pl. 74, f. 2; Pl. 26D and 27A, i*. N. Am. Musc. Pl. 181 & 188.

Forma ACANTHOCLADUS Moenkem. Filiform; parallel to *Kneiffii pungens*.

Forma FILICUSPIS Moenkem. Leaves with a slender acumination about ½ the length of the rest of the leaf, often falcate to secund, (N. Am. Musc. Pl. 289 & 365) frequently producing *capillifolius* forms with excurrent costa.

Forma GRACILESCENS (Br. & Sch. Bry. Eur. *pl. 605*) Moenkem. l. c.

Hypnum conflatum C. M. & Kindb. Cat. Can. Pl. **6**: 230. Type seen.

Slender, yellowish-green; often subpinnately branching; leaves strongly secund with a rather short channelled acumination. M. H. M. *pl. 74, f. 10; Pl. 28A and 27Ak*. N. Am. Musc. Pl. 365 & Suppl. 23; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 316b. Its subforma *tenuis* is almost filiform with very small leaves having a very short costa; the midget of the species, often only 1 cm. long. N. Am. Musc. Pl. Suppl. 20 is close to this form. *Pl. 27A, l*.

Forma UNCUS **n. forma.** Differs from typical var. *polycarpus* in having strongly secund leaves. It is like a large *gracilescens*. Some forms are extremely difficult to distinguish from *Cratoneuron filicinum* except for the lack of paraphyllia. Other forms are much like *D. Sendtneri* except for the much more inflated alar cells forming larger auricles. Type, Allen, Mosses Cascade Mts. 136.

Var. *polycarpus* produces both *intermedius* and *capillifolius* forms when submerged. Often these forms can be recognized as of *polycarpus* origin by the upper leaves, sometimes by the short broad leaf cells of the branch leaves. N. Am. Musc. Pl. 356 and 394 are *polycarpus-intermedius* forms; 183 approaches this form. The type of *Hypnum Jamesii-Macounii* Kindb. Ottawa Nat. **23**: 153. 1909, is a *polycarpus-intermedius* form. Other plants issued as *Jamesii-Macounii* are something different.

Var. PSEUDOFLUITANS (Sanio) was originally described as a submerged form having lanceolate leaves with narrowly linear-flexuose cells and very large auricles, so that the leaf base is excavate into a semicircle, or in some cases into ⅔ of a circle; auricular cells very large and much inflated, hyaline. This form is produced by all three main groups of *aduncus*, probably most frequently by the *typicus* group. M. H. M. *pl. 74, f. 5; Pl. 27A, e.*

There are cases in which all the leaves, the upper seemingly emergent, are of the *pseudofluitans* type; this is the one named by Sanio. But similar forms are produced in differing leaf outlines by all the *aduncus* varieties. In general *pseudofluitans*, *aquaticus* and *intermedius* are descriptive names for submerged forms derived from almost any of the 3 varieties.

Forma PATERNUS (Sanio) is the giant form usually referred to var. *pseudofluitans*, corresponding to the f. *giganteus* of *D. Sendtneri* var. *Wilsoni*. It reaches 30–40 cm. in length, often beautifully pinnate; leaves little falcate or secund, reaching 5 x 1.3 cm., usually somewhat smaller; they may be of the *intermedius* or *aquaticus* type. N. Am. Musc. Pl. 423; 423a approaches this form from an *aquaticus* base as also does Aust. Musc. Appal. 409 (as *aduncus giganteus*).

Forma CAPILLIFOLIUS (Warnst.) Moenkem. l. c.

Hypnum capillifolium Warnst. Bot. Zeit. 1877: 478.

Typically having the costa of all the leaves more or less excurrent, in some cases excurrent into a filiform point of considerable length. Not only most *aduncus* forms but most *Sendtneri* and many *fluitans* forms produce these *capillifolius* forms. Such are produced also by many *Hygroamblystegia* and by *Cratoneuron filicinum*. The *capillifolius* forms of *D. aduncus* are usually submerged, and often only a part of the leaves on a plant will have the excurrent costa. In other cases all of the leaves, including the emergent leaves, will have it. These emergent leaves will usually indicate the basic *aduncus* form which produced the *capillifolius* form in hand. Grout, N. Am. Musc. Pl. 187, 445 & 160, and Sull. & Lesq. Musc. Bor. Am. 316 are *aduncus-capillifolius* forms. (See M. H. M. *pl. 74. f. 9.*)

*9. DREPANOCLADUS SENDTNERI (Schimp.) Warnst. Beih. Bot. Centralbl. **13**: 400. 1903.

Hypnum Sendtneri Schimp. Bry. Eur. Suppl., fasc. 3–4. Hypnum 2. *pl. 2.*

Plants 8–15 cm. long, golden to yellowish-green, brownish below; stems erect, sparingly divided; branching irregular to distantly subpinnate; leaves crowded, secund, often strongly falcate to almost circinate, strongly hooked at the tips of the stems and branches, somewhat twisted when dry, broadly lanceolate to ovate-lanceolate, 1.5–2.5 x 1.1 mm., slenderly acuminate, not plicate, entire; branch leaves similar but smaller; *costa stout, 80–120 μ wide at base, usually extending into the acumen;* median leaf cells 6–8 μ wide, 6–10: 1, oblong to linear-flexuose; towards the leaf base the cells gradually grow broader and shorter with thicker walls, especially in the var. *gracilescens* and other short-leaved forms; *angular cells more or less inflated and colored with usually thick walls* except in young leaves. Dioicous; sporophyte as in *D. aduncus*. Spores rare, spring to summer.

ILLUSTRATIONS.—Schimp., l. c.; Limpr. Laubm. **3**: *f. 409; Pl. 25B.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 13; Aust. Musc. Appal. 404 (as *D. aduncus*).

The above description applies to forma *vulgaris* (Sanio) Moenkem., which is apparently the specific form described by Schimper, l. c.

In its various forms and varieties this species extends across the northern U. S. and Canada northwards, south to N. Carolina and California. It apparently grows in swamps, bogs and wet places containing lime. It parallels the forms of *D. aduncus* so closely and, according to Moenkemeyer, intergrades with it so frequently in its various forms that I am putting forth the hypothesis that it is merely a calcicolous form of that species. A similar difference has already been noted in the calcicolous Hygroamblystegia.

At any rate it will be helpful to consider *Sendtneri* and its varieties as a series of forms paralleling those of *aduncus*, differing from it in its larger size, darker color, more strongly falcate leaves, stronger

and longer costa, thicker cell walls, less enlarged alar cells which are usually deeply colored. The basal cells of *Sendtneri* are also often colored.

(According to Schimper's plate and Dixon's description the leaf cells are nearly uniform to the base, but I do not find this true except in the varieties with longer leaves and it does not agree with the descriptions of later continental authors.)

Forma GRACILESCENS Sanio. This parallels f. *gracilescens* of *D. aduncus polycarpus* and at times is difficult to distinguish from it. The costa is less than 0.05 mm. wide at base, reaching about the middle of the short, shortly acuminate leaves; enlarged alar cells relatively few, thick-walled and golden-brown. Big Bull Arm, Newfoundland (*Hypnum falcatum brevifolium* Kindb. Type collection seen.), Minnesota, N. Carolina, Vermont. Grout, Musci Perfecti 60. This American form may prove to be different from the European, as I have not been able to examine authentic European material.

It seems a quite distinct and recognizable form. It looks like a *Cratoneuron*, but has no paraphyllia. Some forms of *Campylium chrysophyllum* having the alar cells somewhat enlarged at the insertion approach it quite closely.

Forma ARISTINERVIS Moenkem. Laubm. Europ. 766, is the form having an excurrent costa. The costa may be excurrent in almost any form or variety of *Sendtneri*. Undoubtedly such forms were a part of *D. aduncus capillifolius* Warnst. N. Am. Musc. Pl. 246a, 332 and 459 are *aristinervis* forms of var. *Wilsoni*. These forms seem the most frequent of *capillifolius* forms in the West.

Var. WILSONI (Schimp.) Moenkem. in Pascher's Suesswasser fl. **14**: 134. 1894 (as forma).

Hypnum Sendtneri var. *Wilsoni* Schimp., l. c. *pl. 3*.

Plants usually, probably always, submerged, *larger in every way;* stems 15–30 cm. long, less divided or branched in typical forms; leaves more distant, lanceolate and *very slenderly very long-acuminate*, 3–5 mm. long; angular cells fewer and less distinct; costa described by various authors as more slender than in *Sendtneri*, but Dixon and I find it usually as strong.

Schimper's original figures and description give the cells as broader and shorter toward the base, but I find them often almost uniform, except the last two or three rows, and such is the case in an "original" specimen from the type locality determined by Schimper himself and sent me by Renauld. Type locality, Southworth, England.

Grout, N. Am. Musc. Pl. 439 (as *D. Sendtneri*) is this variety, also 246a, 337 and 459. This variety seems to bear much the same relation to the species as *D. revolvens* does to its subspecies *intermedius*. In the first case it is the variety that has the long leaves, in *revolvens* it is the original species itself that has them.

Forma GIGANTEUS (Schimp.) Moenkem. l. c.

Hypnum giganteum Schimp. Syn. (Ed. 1) 612. 1860. *H. hamifolium* Schimp. Syn. (Ed. 2) 732.

Plants floating, very large, reaching 25 cm. in length, more or less pinnately branching; leaves large, reaching 4 x 0.9 mm., often somewhat plicate and rugose, usually strongly falcate-secund.

To this form I have referred all the large floating *Wilsoni* that have been called var. *americanus* Ren. and var. *hamatus*. Schimp.

Moenkemeyer refers Roell's 1242, 1430 & 1431 (which Renauld cites as *D. Wilsoni occidentalis* R. & C.) to a form of *aduncus*.

Sull. & Lesq. Musc. Bor. Am. 316c & 468; Aust. Musc. Appal. 408 & 409.

Budd's Lake, New Jersey, is the classical American locality. New England, New York, Minnesota, Colorado, Washington, Wisconsin.

Var. *Wilsoni* and its forms seem more frequent than the other forms of *Sendtneri*. All forms seem infrequent and local. They should be looked for in alkaline waters.

10. DREPANOCLADUS FLUITANS (L., Hedw.) Warnst. l. c. 404. 1903.

Hypnum fluitans L. Fl. Suec. (Ed. 2) 899. 1755, and Hedw. Sp. Musc. 296. 1801.

Plants soft and slender in most forms, yellowish-green, brown to reddish below, growing in intertangled mats, frequently aquatic and floating; stems prostrate, ascending or floating; branching irregular as a rule, in some cases pinnate; leaves more or less secund and falcate, usually narrower than in *D. aduncus*, narrowly lanceolate or oblong-lanceolate, very gradually tapering to a long flexuose acumination, 3–4 mm. long; narrow at base and widely but not deeply excavate, sometimes almost truncate and straight, more or less decurrent; margins more or less serrulate especially at the apex, plane and flat; costa single, reaching the middle of the leaf or beyond; leaf cells long, 100–120 μ, 20–30: 1, linear-flexuose, almost uniform to

the base; angular cells larger, oblong to rectangular, hyaline or colored, often not sharply delimited and frequently scarcely forming auricles, in other cases reaching well towards the costa. Autoicous; seta 5–10 cm. long, red; capsules oblong-cylindric and arcuate, cernuous; annulus lacking; peristome perfect; operculum conic-apiculate. Spores in early summer.

Type locality European.

EUFLUITANS Moenkem. l. c. (Group *Amphibium* of many authors).

Leaves rather distant and little falcate or secund except at the ends of the stems and branches, flexuose, narrow, distinctly serrate at apex, faintly so at base; angular cells not much enlarged forming a distinct group but not true auricles. This is the typical *fluitans*.

ILLUSTRATIONS.—Bry. Eur. *pl. 602;* M. H. M. *pl. 73.*

EXSICCATI.—Grout, N. Am. Musc. Pl. 276 & 408; Allen, Mosses Cascade Mts. 137 (as var. *brachydictyon*).

A plant of lower elevations, apparently common, in some of its forms at least, in most sections of the northern U. S. and Canada.

Forma JEANBERNATI (Ren.) Moenkem. Leaves oblong-lanceolate, comparatively wide and comparatively short-acuminate; angular cells poorly delimited and relatively inconspicuous. Apparently a common form. M. H. M. *pl. 74, figs. 12 & 13.* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 315. This includes var. *paludosus* Sanio, f. *terrestris* Sanio and f. *condensatus* Sanio.

Subf. *atlanticus* Ren. Stems nearly simple; leaves a little wider below; leaf cells broader, 10–12 wide in the lower leaf. Dixon considers this a degenerate or undeveloped form of f. *Jeanbernati* and I am unable to distinguish the Mt. Mansfield, Vermont specimen (N. Am. Musc. Pl. 103) determined by Renauld, from *f. Jeanbernati.* Forma *elata* (Ren. & Card.) Moenkem. l. c. is only a robust *Jeanbernati.*

Forma GRACILIS (Boul.) is a very slender form, little branched; leaves distant, narrow, with a long slender acumination, strongly serrate; alar cells somewhat inflated but rather poorly delimited. M. H. M. *pl. 74, f. 14;* N. Am. Musc. Pl. 153 & 153a. This should include var. *Delamarei* R. & C. Musc. Am. Sept. Exsic. 133, as the differences are very slight.

Forma SETIFORMIS (Ren.) Moenkem. This seems to be merely a large more robust form of much the same structure as f. *gracilis* but having large well-developed auricles almost large enough at times to qualify for *D. exannulatus, Pl. 29A, l.* Moenkemeyer, l. c., has apparently combined the two under f. *setiformis.* N. Am. Musc. Pl. 277 and 341 (as var. *Jeanbernati*). These two forms (*gracilis* and *setiformis*) are apparently common around the edges of pools and ponds subject to great fluctuations of depth. I have referred to these two forms and to f. *submersus,* plants whose upper leaves at least were rather strongly falcate-secund but otherwise correspond to the European descriptions.

Forma SUBMERSUS is a floating form, little branched as a rule but occasionally subpinnate; leaves distant, slightly or not at all falcate, long and slenderly acuminate (less so than f. *setiformis*) from a rather broad base; alar cells broader and shorter, but slightly differentiated, not sharply delimited. *Pl. 29A, 2.*

Aust. Musc. Appal. 410 (this is close to f. *setiformis*); N. Am. Musc. Pl. 285 (as var. *pinnatus* Boul.). This last is intermediate between f. *submersus* and var. *falcatus.*

Var. FALCATUS (Br. & Sch.) Roth. More robust, yellowish to red above, often a deep red-brown below; leaves usually strongly falcate, strongly hooked at stem and branch ends, more or less truncate at insertion, rather shortly acuminate; basal cells incrassate; costa stronger; auricles usually developed and formed of inflated cells.

M. H. M. *pl. 73,* β, *figs. 1 & 2; pl. 74. f. 6; Pl. 29A, f. 3.* N. Am. Musc. Pl. 104.

Apparently not rare at high altitudes on wet rocks. Likely to be mistaken for *D. revolvens,* from which it is distinguished by its denticulate leaf-apex and inflated alar cells.

*11. DREPANOCLADUS EXANNULATUS (Guemb.) Warnst. l. c. 405.

Hypnum exannulatum Guemb. Bry. Eur., fasc. 57–61. 34. *pl. 603.* 1854.

Subspecies of *D. fluitans* from which it differs chiefly as follows. Tufts usually more compact, more pinnately branched, more often purplish below; leaves typically broader at base, ovate-lanceolate, more shortly acuminate and more strongly falcate (except in the case of *fluitans falcatus*), often lightly striate when dry; costa stronger, often nearly percurrent; in nearly all forms *a much larger group of inflated and hyaline auricular cells, usually reaching the costa and forming large decurrent auricles.* Frequently dioicous.

Type locality European.

ILLUSTRATIONS.—Bry. Eur. l. c.; Dixon and Jam. Handb. Brit. Mosses *pl. 58C;* M. H. M. *pl. 74, figs. 7, 8 & 16.*

Exsiccati.—Aust. Musc. Appal. 403; Grout, N. Am. Musc. Pl. 159 and 444, also Suppl. 14.

Northern U. S. and Canada across the continent, south to New Jersey, Pennsylvania and Colorado. Various intermediate forms between this and *D. fluitans*, and between the various forms described are frequent and puzzling.

The description above is intended to include f. *pinnatus* (Boulay) and f. *falcatus* Moenkem. as well as the typical form. All of these have very long and narrow leaf cells as contrasted with var. *brachydictyus*.

Forma *orthophyllus* Moenkem. has straight leaves; f. *obtusus* Moenkem. has at least a portion of its leaves obtuse; f. *tenuis* Moenkem. is an exceedingly slender, almost filiform plant.

Var. rotae (DeNot.). Leaves often purplish to brown, narrower, very longly filiform-acuminate, reaching 4–5 mm. in length, denticulate; costa from nearly percurrent to long-excurrent; leaf cells very long and narrow, 4–6 μ wide and 10–20: 1. Pocono Mts., Pennsylvania; California.

Forma submersus Moenkem. is a very long slender floating form, sometimes filling the water to a depth of 6–8 feet. It has an unusually large group of inflated alar cells. It is a parallel form to *D. fluitans submersus* and *D. aduncus aquaticus*.

Forma falcifolius (Ren.) is much like f. *submersus* in leaf outline but the leaves are usually much more falcate with a smaller group of inflated alar cells, which are usually in a single row and somewhat incrassate. The plants are usually more or less regularly pinnate. *Pl. 29C.* N. Am. Musc. Pl. 347.

Forma *submersus pinnatus* Moenkem. is one of the most striking mosses known to the author. It is long and floating, reaching 30 cm. or more in length, plumose with the long pinnately arranged branches, making fronds 3–4 cm. wide. At first sight it reminds one of an aquatic flowering plant with finely pinnatifid leaves. An excellent example was collected in Alaska by Howell (Pacific Coast Plants No. 1811 in the herbarium of the N. Y. Botanical Garden).

The costa in var. *rotae* is often excurrent, corresponding to the *capillifolius* forms of *D. aduncus*. All the varieties of *exannulatus* occasionally produce leaves with excurrent costa. But this happens much more frequently in the var. *rotae*.

Var. brachydictyus (Ren.) Grout, M. H. M. 311. 1908.

Plants usually green, occasionally reddish, softer and less regularly pinnate than the preceding forms of *exannulatus;* leaves also much shorter and more shortly acuminate, less serrate, often almost entire; leaf cells much shorter but little broader, 6–7 μ wide, 5–9: 1; costa usually very strong, 0.07–0.10 mm. wide, reaching well into the acumination, occasionally percurrent or even excurrent; auricles of inflated cells well developed but usually rather smaller than in most other forms of *exannulatus*. Type European, probably French. M. H. M. *f. 162.*

In marshy places and edges of peat-bordered lakes; arctic-alpine. Mt. Washington, N. H., alt. 5500 ft.; near Sperry Glacier and Lake Macdonald, Montana, Holzinger; Jasper National Park, Alberta, MacFadden.

Forma tundrae (Arnell) Moenkem. l. c.

Amblystegium tundrae Arnell, K. Sv. Vet.-Ak. Handl. **23**[10]: 128. 1890.
Hypnum amblyphyllum Williams, Bull. N. Y. Bot. Gard. **2**: 139. *pl. 24.* 1901. (Type seen).

Leaves shorter, slightly secund at ends of stem and branches, sometimes slightly plicate, often obtuse and subcucullate at apex; apex occasionally inflexed; Dawson, Yukon Terr., in fruit. Williams. *Pl. 29B.*

The author has not seen authentic specimens of *A. tundrae* but has compared type specimens of *H. amblyphyllum* carefully with descriptions and figures of *tundrae*. This seems to be a rare reduced arctic form.

*Drepanocladus Berggrenii (C. Jens.) Broth. Engler & Prantl, Musci (Ed. 2), **2**: 344.

Harpidium fluitans **Berggrenii* C. Jens. Meddel. om Groenl. 3: 6. 1887.

Tufts yellow-green, brown below; stems flexuose, sparingly branched; lower leaves *from a broadly ovate base shortly and obtusely acuminate, with incurved margins*, somewhat falcate-secund, entire or distantly and faintly serrulate at apex; median stem leaves ± 0.6 x 1.4 mm.; costa scarcely reaching the middle of the leaf, often forking; median leaf cells rather long and slender, ± 8 x 68 μ, rather thick-walled, flexuose; cells at the basal angles short-rectangular, incrassate, colored, *very few inflated;* inner perichaetial leaves entire, with costa short or wanting. Autoicous; capsule on a long slender seta, *erect to somewhat cernuous*, about 2 x 0.75 mm., *short-ovoid;* annulus lacking. Type from Greenland studied through the courtesy of Dr. Jensen.

Differs from *D. fluitans typicus* chiefly in being more slender, with smaller and relatively shorter leaves; costa scarcely reaching the middle of the leaf, often bifid; leaf cells with thicker walls; capsules suberect.

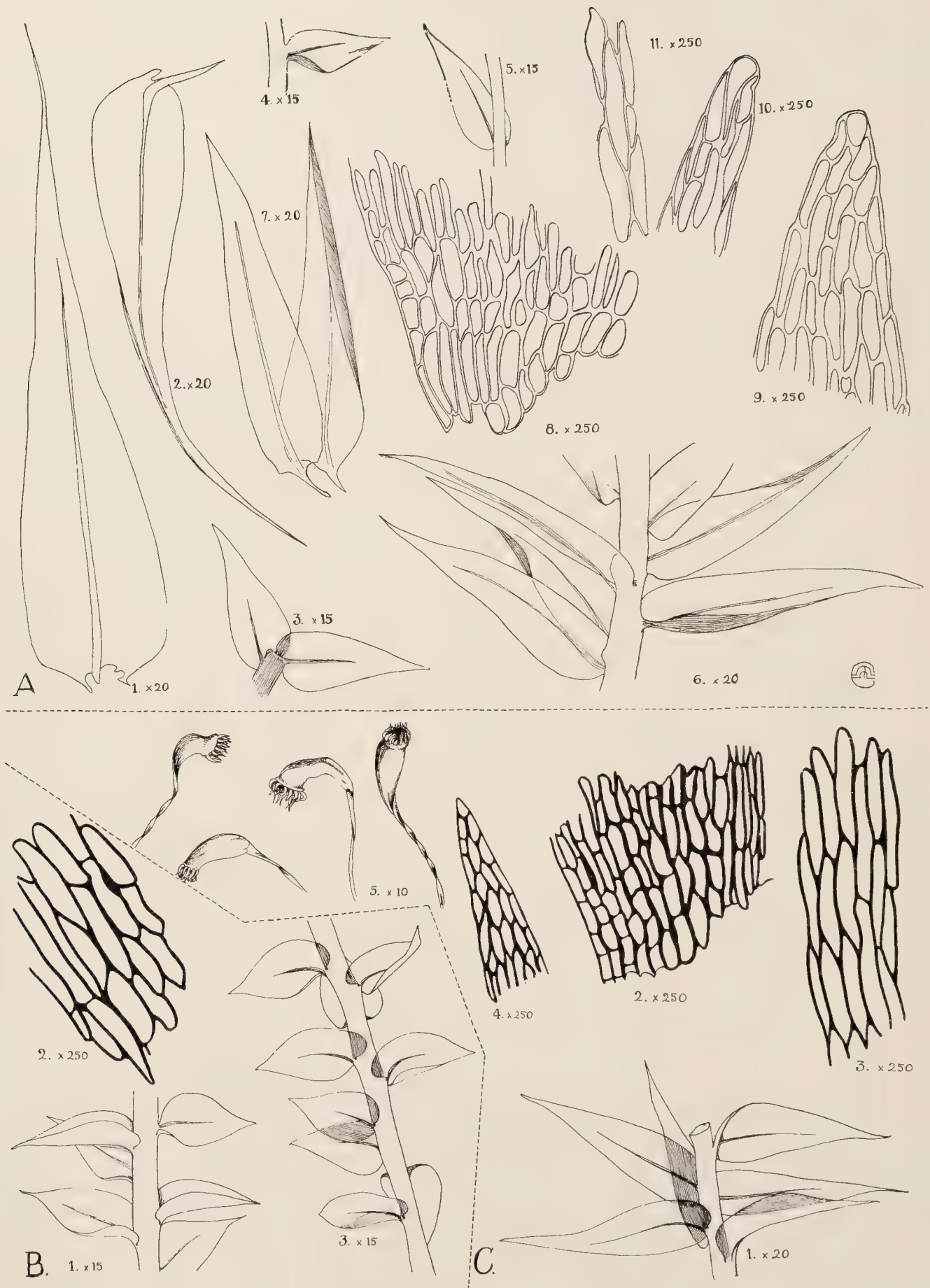

A
1. x20
2. x20
3. x15
4. x15
5. x15
6. x20
7. x20
8. x250
9. x250
10. x250
11. x250
B.
1. x15
2. x250
3. x15
5. x10
C.
1. x20
2. x250
3. x250
4. x250

PLATE XV.

PLATE 15. *A*, 1, leaf of *Leptodictyum riparium longifolium;* 2, leaf of the same from an English specimen; 3, leaves of the broad-leaved *L. riparium* from Indiana, Welch; 4, emergent branch leaf and 5, submerged stem leaf of the same plant from N. Am. Musc. Pl. 295; 11, median cells of 4; 6, stem with leaves of *L. riparium;* 7, two leaves of *L. riparium obtusum;* 8, basal angular cells of the same, 9 and 10, apex and apical cells; Figs. 7–10 from N. Am. Musc. Pl. 471.

B, 1, stem and leaves of *L. brevipes*, Sheldon, no. 2343; 2, median cells of the same; 3, *L. brevipes*, Iowa, Conard.

C, *L. sipho*, N. Am. Musc. Pl. 248; 1, stem and leaves; 2, 3 and 4, angular, median, and apical cells; 5, capsules. All figures on this plate except C5 made with camera lucida.

PLATE 16. Fig. 1, *Leptodictyum riparium flaccidum* (from Jennings, Mosses W. Pa. *pl. 38* (by permission); *p*, plant natural size; *y*, portion of stem; *z*, leaves; *a*, apical cells of leaves; *b*, basal cells; *c*, median cells.

Fig. 2, *Leptodictyum brevipes* (from Minnesota Bot. Stud. **3²**: *pl. 20*); *a*, entire plant × 1; *b*, *b*, leaves × 26; *c*, perichaetial leaf × 26; *d*, basal areolation of leaf × 195; *e*, areolation in the middle × 195; *f*, areolation of the upper part × 195; *g*, capsule in the dry state × 13; *h*, the same moist × 13; *i*, operculum × 13.

Fig. 3. (*a* brachy) *Leptodictyum riparium brachyphyllum* (from Minn. Bot. Stud. **3²**: *pl. 20*); *a*, plant × 1; *b*, leaf × 26, *d*, median cells × 195.

Fig. 4, *H. irriguum spinifolium* (drawn from N. Am. Musc. Pl. 438); *a*, lower stem leaf; *b*, upper leaf from the same stem; *c*, leaf from another stem from the same tuft.

Fig. 5, *a* and *b*, *Amblystegium varium lancifolium*, stem leaves from the type.

Fig. 6, *Hypnum sipho* P. B., Carolina, Bosc (from a specimen in herb. Schwaegr.); *a*, two leaves × 30; *b*, capsule × 14.

Fig. 7, *Amblystegium floridanum* R. & C. *a*, two leaves × 30; *b*, capsule × 14. (From an original specimen collected in Florida by Fitzgerald); *c*, two leaves × 30; *d*, capsule × 14. (From a specimen collected in Louisiana by Langlois, R. & C. Musc. Am. Sept. Exs. 129.)

Figs. 6 and 7, from Revision des types Hedwig et de Schwaegrichen by J. Cardot, Bull. Herb. Boissier **7**: *pl. 10*. 1899.

Fig. 8, *A. varium ovatum; a*, portion of stem of Austin's 377 × 3; *b*, leaf.

Fig. 9, *Hygroamblystegium irriguum marianopolitanum* from Minnesota, Holzinger; *a*, stem leaf × 22 and median cells × 90; b, branch leaf × 22 and median cells × 90.

Fig. 10, *Amblystegium varium laxum*, Indiana, Deam.

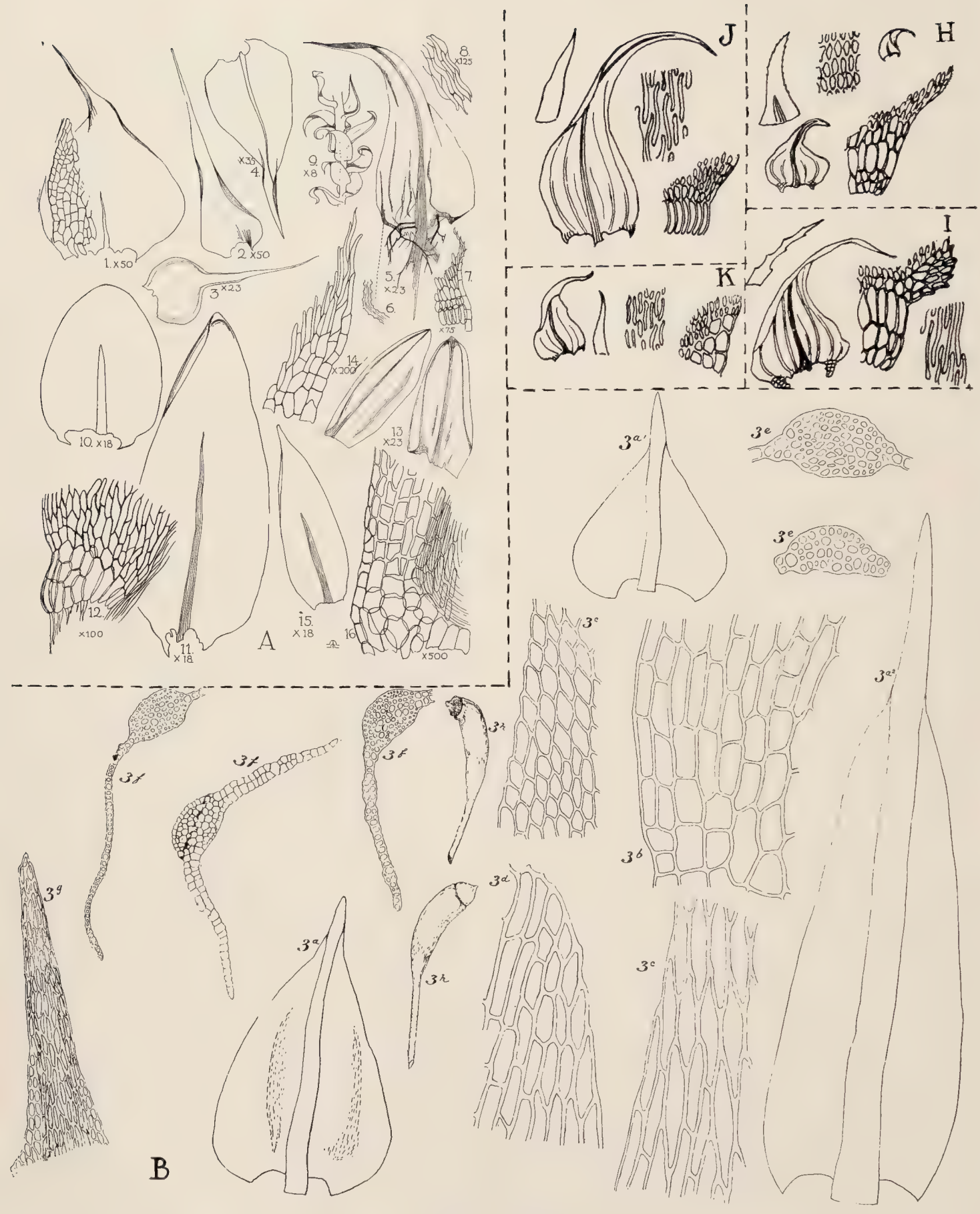
Fig. 11, *A. Juratzkanum*, *a*, stem leaf of plant from Berlin, comm. Loeske; *b*, basal angular cells of same; *c*, same cells from var. *giganteum*.

Fig. 12, two leaves of *Lepidictyum trichopodium*.

Fig. 13, *a*, two leaves *Hygroamblystegium fluviatile ovatum*.

4a. x22
4b x 22
4c x 22
13a x22
5a. x22
5b. x22
11c x 125
12 x 22
9b x22
x90
9a x22
3a
3b
3d
6b
7d
7b
7c
7a
6a
8b x20
8a x3
10. x22
11a x22
11b. x125
2a
2b
2c
2d
2e
2f
2g
2h
2i
1a
1b
1c x 75
1d x 10
1e x 10
1f
1g
1h
x200
x5
x1

PLATE XVI.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9. x8
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12. x100
13. x23
14. x200
15. x18
16
x500
A
J
H
I
K
3a
3e
3e
3c
3a2
3b
3f
3f
3f
3h
3g
3a
3h
3a
3c
B

PLATE XVII.

PLATE 17. *A*. Fig. 1, stem leaf *Campylium hispidulum cordatum* (from the type) and the basal angular areolation × 80; 2, stem leaf of var. *Sommerfeltii;* 3, stem leaf of *C. stellatum protensum* (note that it is magnified only ½ as much as fig. 2); 4, stem leaf of *C. polygamum fluitans:* figs. 5–9, *Cratoneuron papillosum* from type specimens; 5, stem leaf; 6, ventral fold showing papillae; 7, alar cells; 8, median leaf cells; 9, portion of stem: figs. 10–12, *Calliergon Richardsoni;* 10, leaf from Mitten's type; 11, leaf from plant collected by Cooper on Isle Royale, Michigan; 12, alar cells: 13–14, *Hygrohypnum polare;* 13, two leaves; 14, alar cells: 15–16, *Calliergidium pseudostramineum Hoveyi* from the type, 15, leaf; 16, alar cells × 250 (*not 500*).

B. Hygroamblystegium noterophilum after Cheney, Bot. Gaz. **24:** *pl. 12.* *a* and a^1, leaves, terrestrial form × 85; a^2, leaf, large aquatic form × 85; *b*, *c*, and *d*, cells respectively from the alar, middle border and apical region × 580; *c*, cells from the middle border region of the terrestrial form × 580; *e*, cross-sections of the costa at the middle of the leaf and just above the lamina × 160; *f*, cross-sections of the leaf; *g*, tip of leaf of the large aquatic form; *h*, capsule.

H, Cratoneuron decipiens; I, C. commutatum; J, C. falcatum; K, C. sulcatum (*H, I, J,* and *K* from Dixon and Jam. Handb. Brit. Mosses); all leaves × 15; apices × 60; median leaf cells × 180; alar cells × 90.

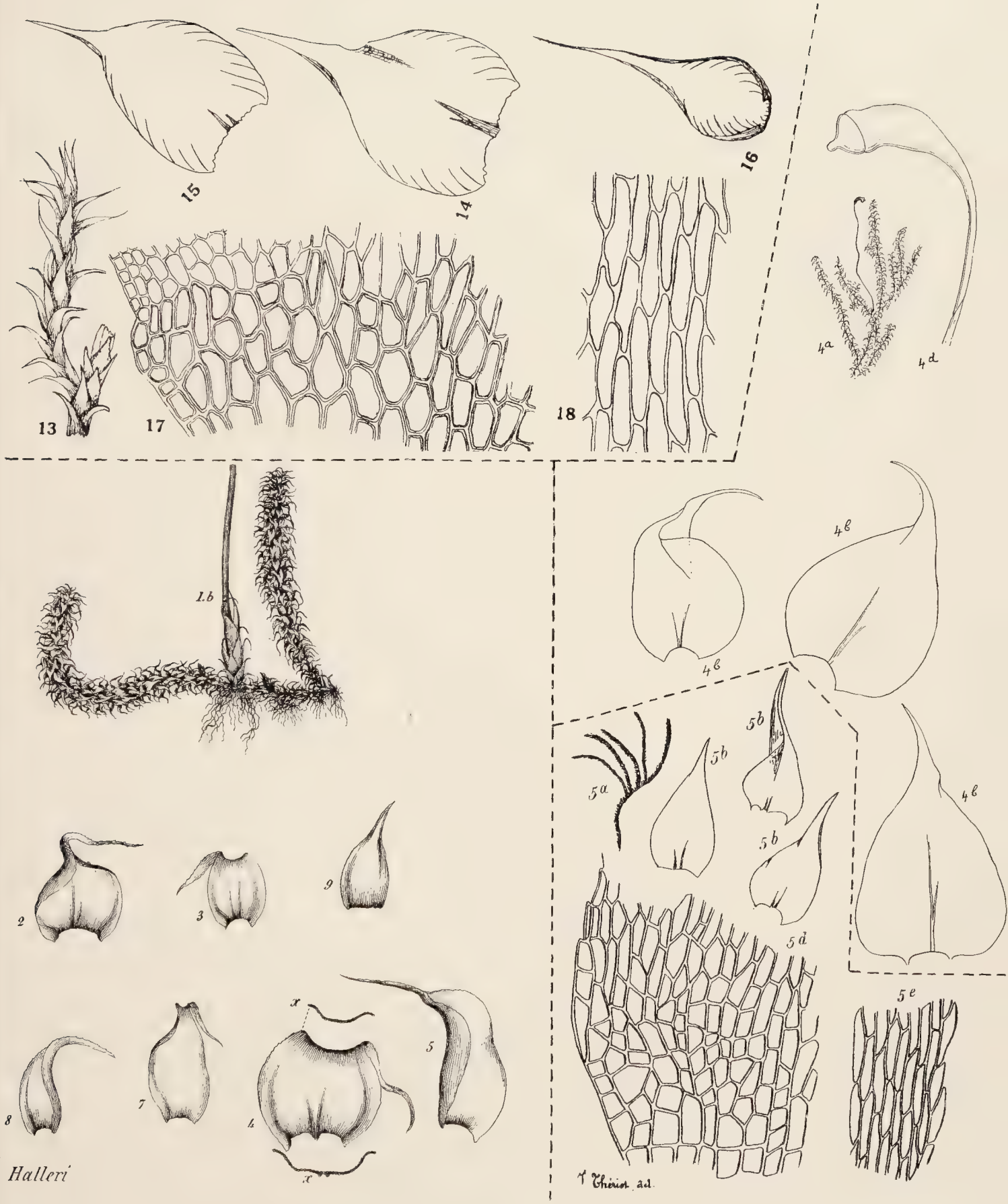
PLATE 18. Figs. 1–9, *Campylium Halleri* (from Bry. Eur. *pl. 581*). *1b*, portion of a plant × 10; 4–5, stem leaves; 2, 3, 7 and 8, branch leaves; 9, perichaetial leaf. All leaves highly magnified.

Figs. 13–18, *Campylium arcticum*. 13, plant × 6; 14, 15, stem leaves × 19; 16, branch leaf × 19; 17, basal leaf cells × 210; 18, median leaf cells × 245.

Figs. 13–18 are from the original illustrations by Williams, Rept. Can. Arctic Exped. *pl. 15E*, to accompany the original description.

Figs. 4*a*–4*d*, *Campylium Cardoti* (from Bot. Gaz. **30**: *pl. 11*), *a*, entire plant × 1; *b*, *b*, *b*, leaves × 32; *d*, capsule × 13.

Figs. 5*a*–5*e*, *Campylium Treleasei* (from Proc. Wash. Acad. Sci. **4**: *pl. 22*). *a*, entire plant × 1; *b*, *b*, *b*, leaves × 26; *d*, basal areolation of leaf × 270; *c*, median leaf cells × 270.


15
14
16
13
17
18
4a
4d
1b
4b
4b
5b
5a
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2
3
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8
7
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x
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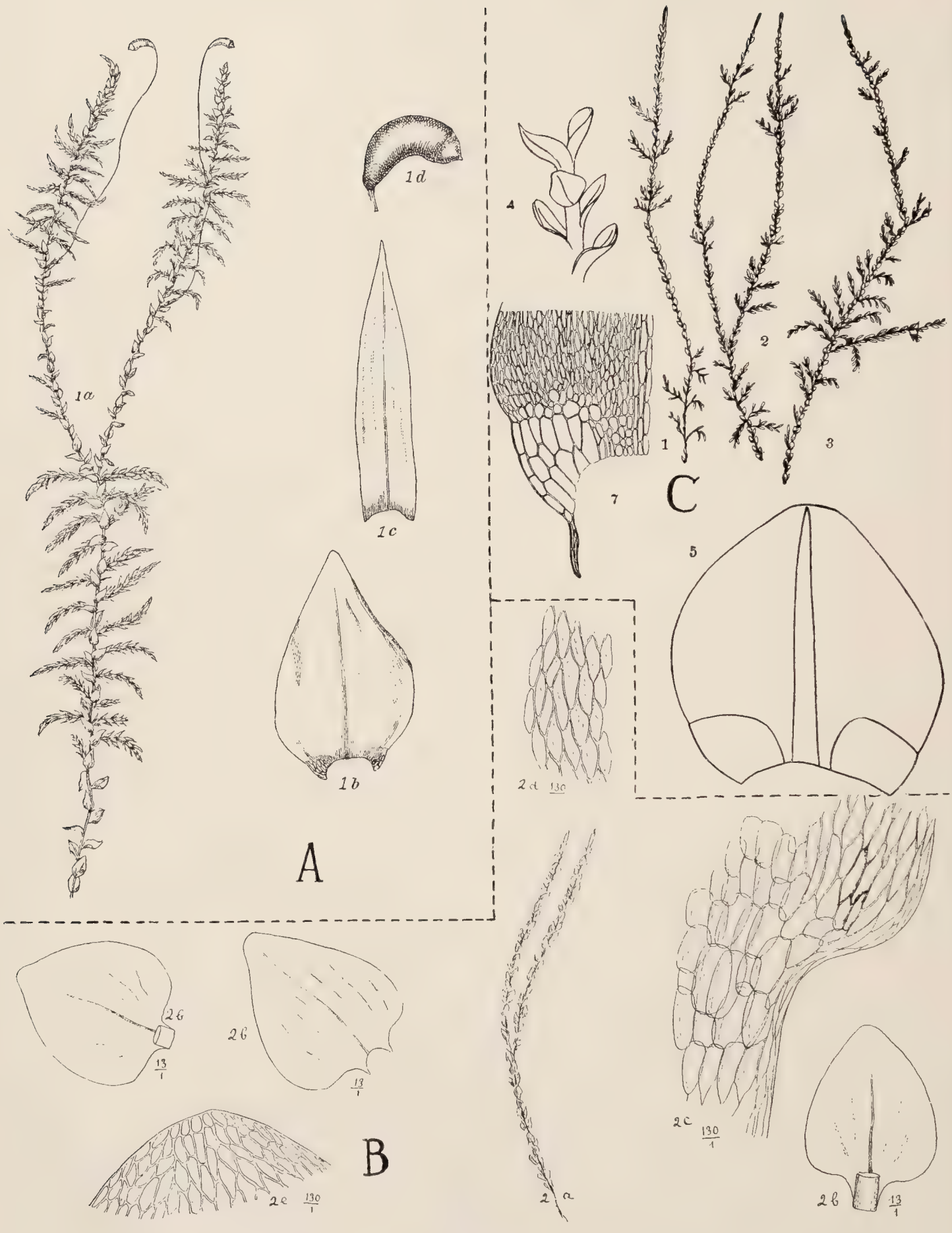
5
Halleri

PLATE XVIII.


1a
1d
1c
1b
A
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7
C
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2d 130/1
2a
2c 130/1
2b 13/1
2G
13/1
2G
13/1
2e 130/1
B

PLATE XIX.

PLATE 19. *A. Calliergon giganteum* (from Limpr. Laubm. **3:** *fig. 432*). 1*a*, plant × ¾; 1*b*, stem leaf × 15; 1*c*, perichaetial leaf × 15; 1*d*, capsule × 8.

B. Calliergon orbiculari-cordatum (from Bot. Gaz. **22:** *pl. 4*); *a*, entire plant; *b*, *b*, *b*, leaves; *c*, basal areolation of leaf; *d*, median leaf cells; *e*, apical leaf cells. The costa is very rarely as short as is shown in two of the leaves.

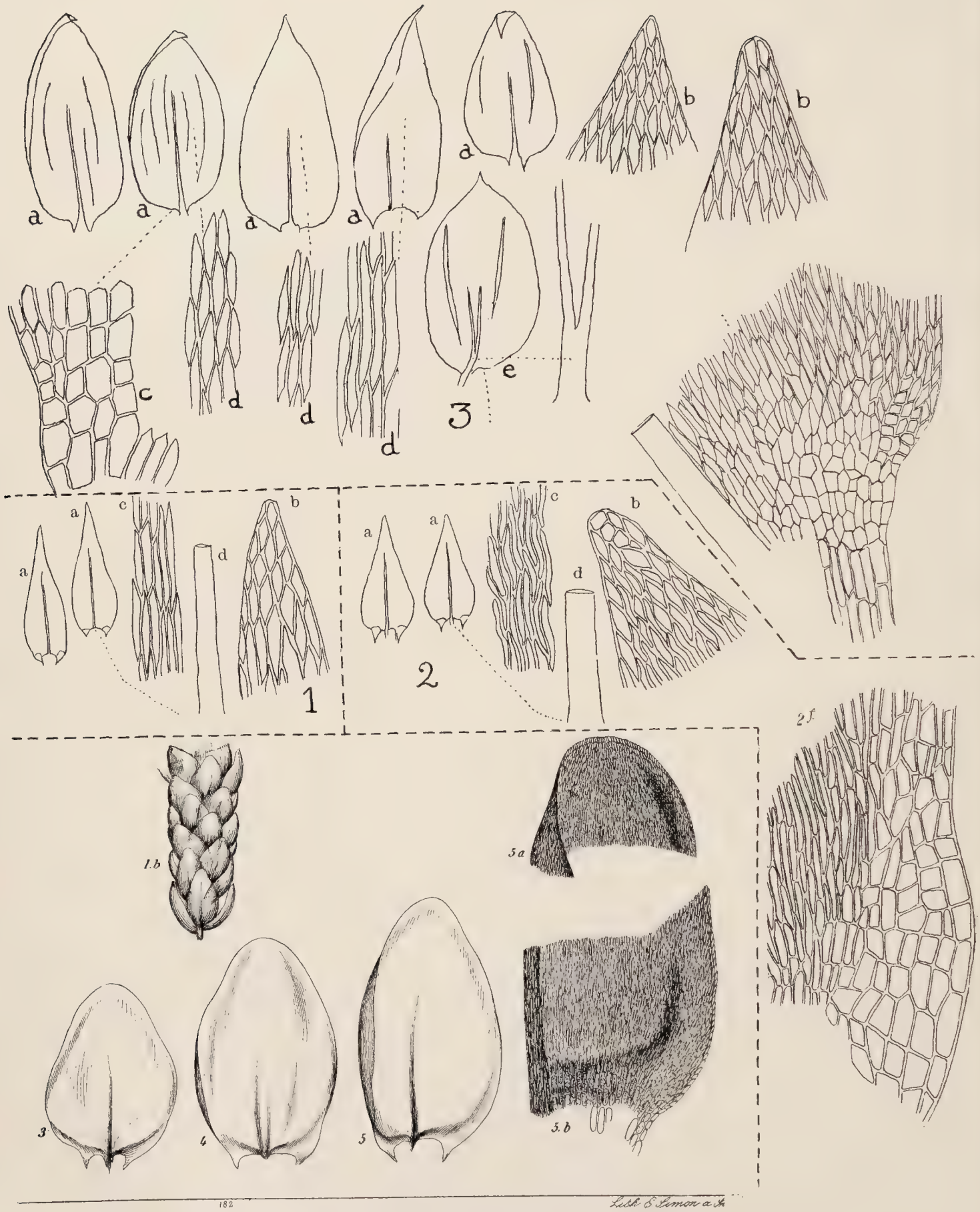
C. Calliergon giganteum cyclophyllotum; 1, 2, 3, plants × 1; 4, portion of stem enlarged to show leaf arrangement; 5, stem leaf × 56; 7, angular cells × 56 (from Minn. Bot. Stud. Bull. **9:** *pl. 39*).

PLATE 20. *Calliergon sarmentosum.* 1*b* and 2*b*, portions of stem enlarged; 3–8, stem leaves; 10 and 11, branch leaves; 3*a*, 4*a*, 4*b* and 8*a*, portions of leaves more highly magnified to show details (from Bry. Eur. *pl. 616*).

Calliergon stramineum. 2*b*, portion of stem enlarged; 3–6, stem leaves; 7, branch leaf; 4*a*, 4*b* and 6*a*, portions of leaves more highly magnified to show details; 8, 9 and 10, antheridial bud and perigonial leaves (from Bryol. Eur. *pl. 617*).

2.b
8
9
10
4.a.a
4.a
6.a
3
4
5
6
x'
7
4.b
x
Stramineum
2.b
1.b
7
x
10
11
8.a
3.a
4.a
8
9
4
3
5
6
x'''
x''
x'
x
4.b
sarmentosum

PLATE XX.



182

Lith. & Simon a. Sc.

PLATE XXI.

PLATE 21. Figs. 1*b*–5*b* (lower left) *Calliergon trifarium.* 1*b*, portion of stem enlarged; 3–5, leaves; 5*a* and 5*b*, apex and base of leaf respectively, greatly enlarged to show details (from Bry. Eur. *pl. 618*).

1. *Calliergidium pseudostramineum.* *a*, *a*, stem leaves × 16; *b*, apical cells × 200; *c*, median leaf cells × 200; *d*, basal part of costa × 120.

2. *C. pseudostramineum* var. *plesistramineum.* *a*, *a*, stem leaves × 16; *b*, apical cells × 200; *c*, median leaf cells × 200; *d*, base of costa × 120; × *2f*, angular leaf cells × 225.

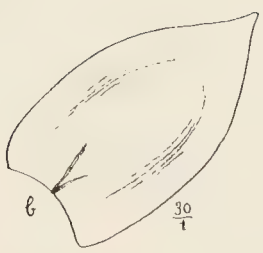
3. *Calliergidium Bakeri.* *a*, *a*, *a*, *a*, *a*, and *e*, leaves × 18; *b*, *b*, leaf apices × 225; *c*, alar cells × 225; *d*, *d*, *d*, median leaf cells from different leaves as indicated × 225; the unlettered figure at the right illustrates the basal and alar cells of leaf *e* × 140. All figures in 1, 2 and 3 except *2f* are from the Bryologist **4**: *plates 7* and *8*. *2f* is from Vol. 4, *pl. 23* of Proc. Wash. Acad. Sci.

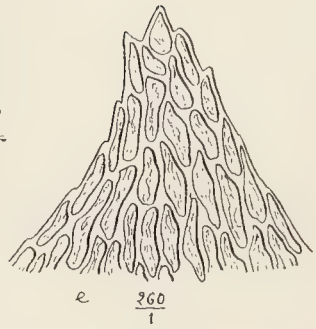
PLATE 22. *A. Hygrohypnum subeugyrium* (from Bot. Gaz. **22:** *pl. 5*) *a;* entire plant; *b*, *b*, *b*, stem leaves; *c*, *d*, and *e*, angular, median and apical leaf cells respectively.

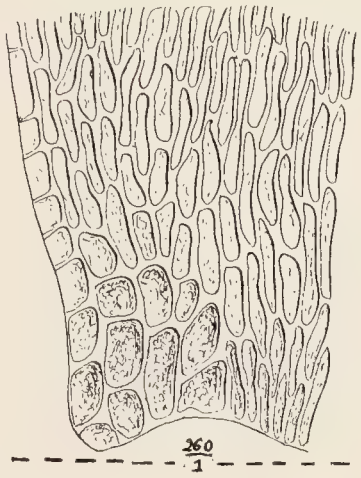
B. Hygrohypnum montanum (from Sull. Icon. Musc. *pl. 113*); *1*, branch, enlarged; 3, 4, 5 and 6, branch leaves; 7, basal areolation; 8 and 9, apical areolation.

C. Hygrohypnum molle (from Dixon & Jam. Handb. Brit. Mosses *pl. 59N*). 1, leaf × 15; 2, leaf apex × 60; 3, apical cells × 180; 4, median cells × 180.

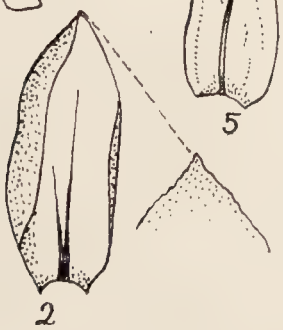
D. Hygrohypnum alpestre (from Husnot, Musc. Gall. *pl. 119*). 1, plant × 1; 2, leaf much enlarged with leaf apex still more magnified; 3, angular leaf cells; 4, median leaf cells; 5, perichaetial leaf.



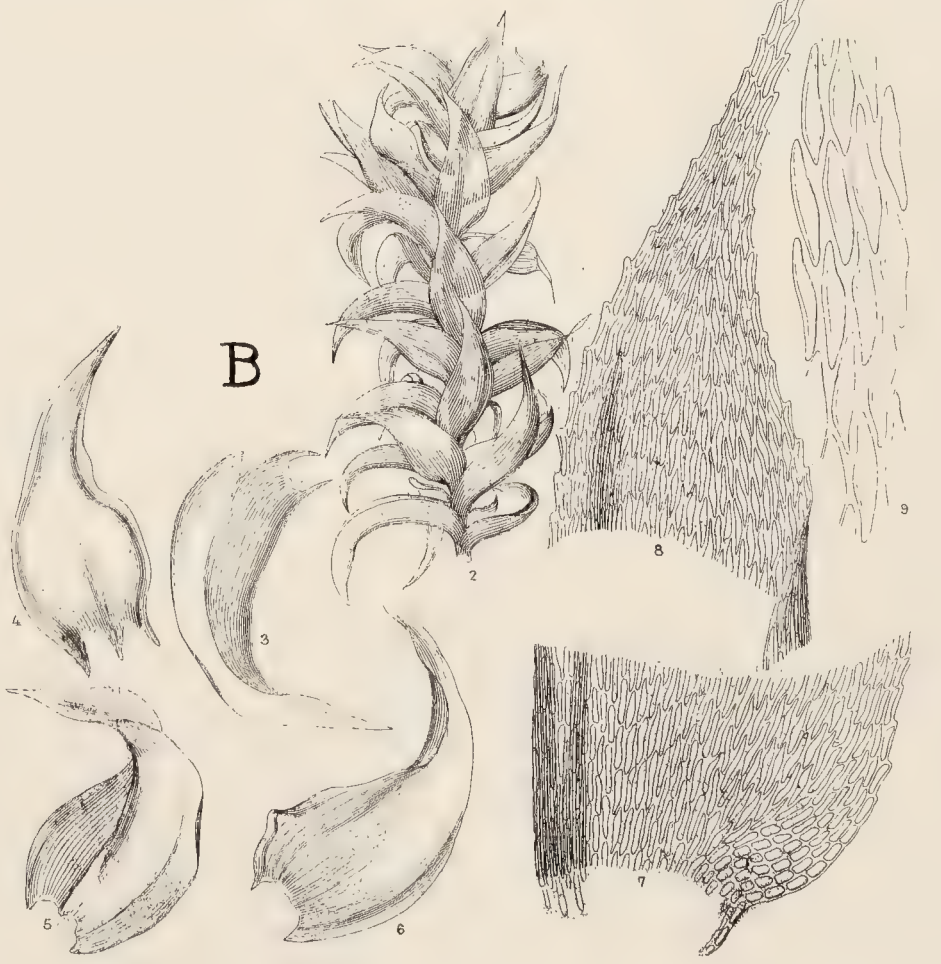


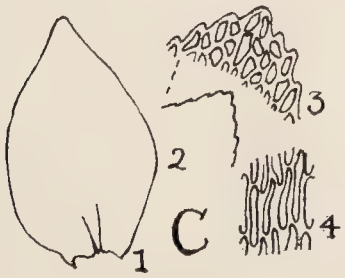


A



D

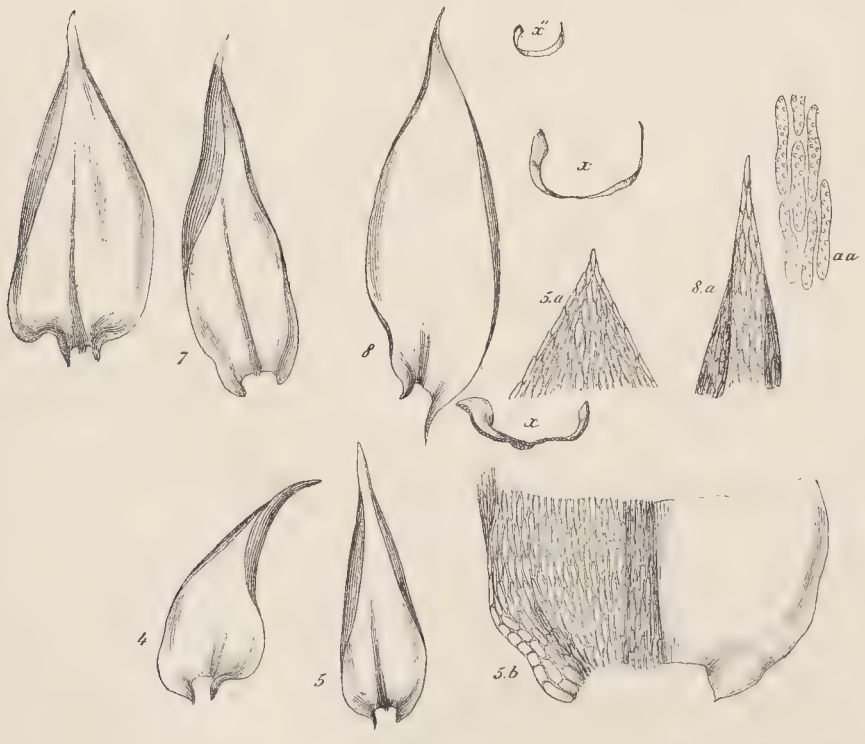




C

PLATE XXII.

D



C

Lith. de Lemoir a Nancy

PLATE XXIII.

PLATE 23. Upper left, *Hygrohypnum Smithii* (from Bry. Eur. *pl. 578*). 5, leaf much magnified; 5*b*, leaf showing cell structure (marginal cells incorrectly drawn); 14, capsule enlarged.

Lower left, *Hygrohypnum palustre* (from Bry. Eur. *pl. 574*). 4–8, leaves much enlarged; 5*a* and 8*a*, leaf apices; 5*b*, leaf base.

Upper right, *H. palustre subsphaericarpum* (Bry. Eur. *pl. 575*). 1, branch enlarged; 2 and 3, leaves.

Lower right, *H. palustre julaceum* (Bry. Eur. *pl. 575*). 1, branch enlarged; 2 and 3, leaves.

PLATE 24. *A. Hygrohypnum closteri* (from Bot. Gaz. **19**: *pl. 21C*). *a*, entire plant; *b*, *b*, *b*, *b*, leaves; *c*, *d*, and *e*, cells from the basal angle, the middle of the leaf and the leaf apex, respectively; *f*, operculate and *g*, deoperculate capsule.

B. Hygrohypnum pseudomontanum. 1, lower portion of stem; 2, portion of upper part of the same stem; 3, 4, 5 and 6 leaves from lower portion of stem; 7, leaf from upper portion of stem; 8, median leaf cells; 9, basal and angular cells. Drawings made from the type.

C. Hygrophynum norvegicum (from Bry. Eur. *pl. 576*). Three stem leaves and basal and apical cells.

D. Drepanocladus aduncus (from Bry. Eur. Suppl. Hypnum, *pl. 1*). *B5*, two stem leaves of a form approaching f. *Kneiffii; 4b*, lower portion of leaf showing cell structure; *4a*, median leaf cells less enlarged than those in *4b*.

E. Figs. 1 and 2, leaves and angular leaf cells of *Drepanocladus badius.* Drawings from a Spitzbergen specimen.

Figs. 4, 5 and 6, leaves, angular and median leaf cells of *Drepanocladus brevifolius.* Drawings from a Labrador specimen.

A
B
C
D
E
nat. size
1 x8
2 x8
9 x150
3. x20
4. x20
5. x20
6 x20
7 x20
8. x150
5 x125
6. x125
4a
4b
B5

PLATE XXIV.

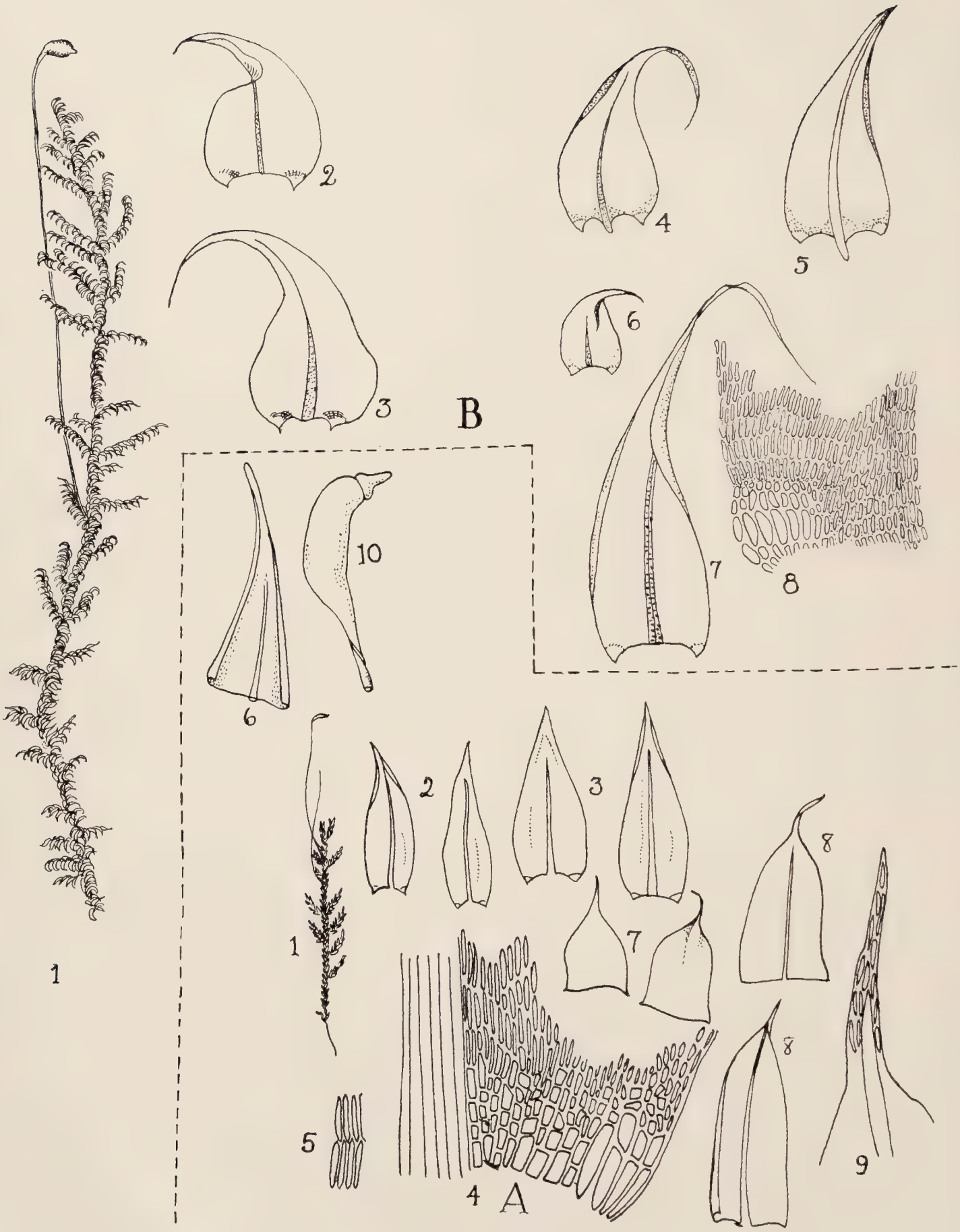


PLATE XXV.

PLATE 25. *A. Calliergon pseudosarmentosum* (Univ. of Calif. Pub. Botany **2:** *pl. 27*). 1, plant × 1; 2, branch leaves × 17; 3, stem leaves × 17; 4, basal areolation of a stem leaf × 135; 5, median leaf cells × 135; 6, apex of a branch leaf × 90; 7 and 8, perichaetial leaves × 17; 9, apex of a perichaetial leaf × 90; 10, immature capsule × 13.

B. Drepanocladus Sendtneri (figs. 1–3 from Limpr. Laubm. **3:** 392, *fig. 409*). 1, plant × 1; 2 and 3, stem leaves × 30. *2*, drawn from Bryoth. Siles., and *3* from an English plant. (Figs. 4–8 from Moenkemeyer in Pascher Suesswasserfl. **14:***f. 48*). 4, stem leaf of the normal form; 5, stem leaf of the "*capillifolius*" form with excurrent costa; 6, leaf of a form paralleling *D. aduncus polycarpus gracilescens;* 7, stem leaf of var. *Wilsoni;* 8, basal areolation of 4.

PLATE 26. *A. Drepanocladus lycopodioides* (from Bry. Eur. *pl. 613*). 1, plant × 1; 2 and 4, stem leaves; 3, branch leaf.

B. Calliergon turgescens (from Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *pl. 60H*). 1, stem leaf × 15; 2, leaf base × 15; 3, leaf apex × 60; 4, median leaf cells × 180; 5, alar cells × 180.

C. Leaves and median leaf cells of *Hygrohypnum Bestii* (from Bryologist **4**: *pl. 3*). Leaves × 16, leaf cells × 200.

D. Copies of the original drawings by Blandow to illustrate *Hypnum polycarpum.* 1, stem leaf and median cells; 2, branch leaf.

E. Stem leaf × 20 and angular cells × 200 of *Drepanocladus revolvens miquelonensis* from Musc. Am. Sept. Exsicc. 131 at the New York Botanical Garden.

F. Drepanocladus aduncus Kneiffii. Three stem leaves from Bry. Eur. *pl. 573*. This plate represents the type.

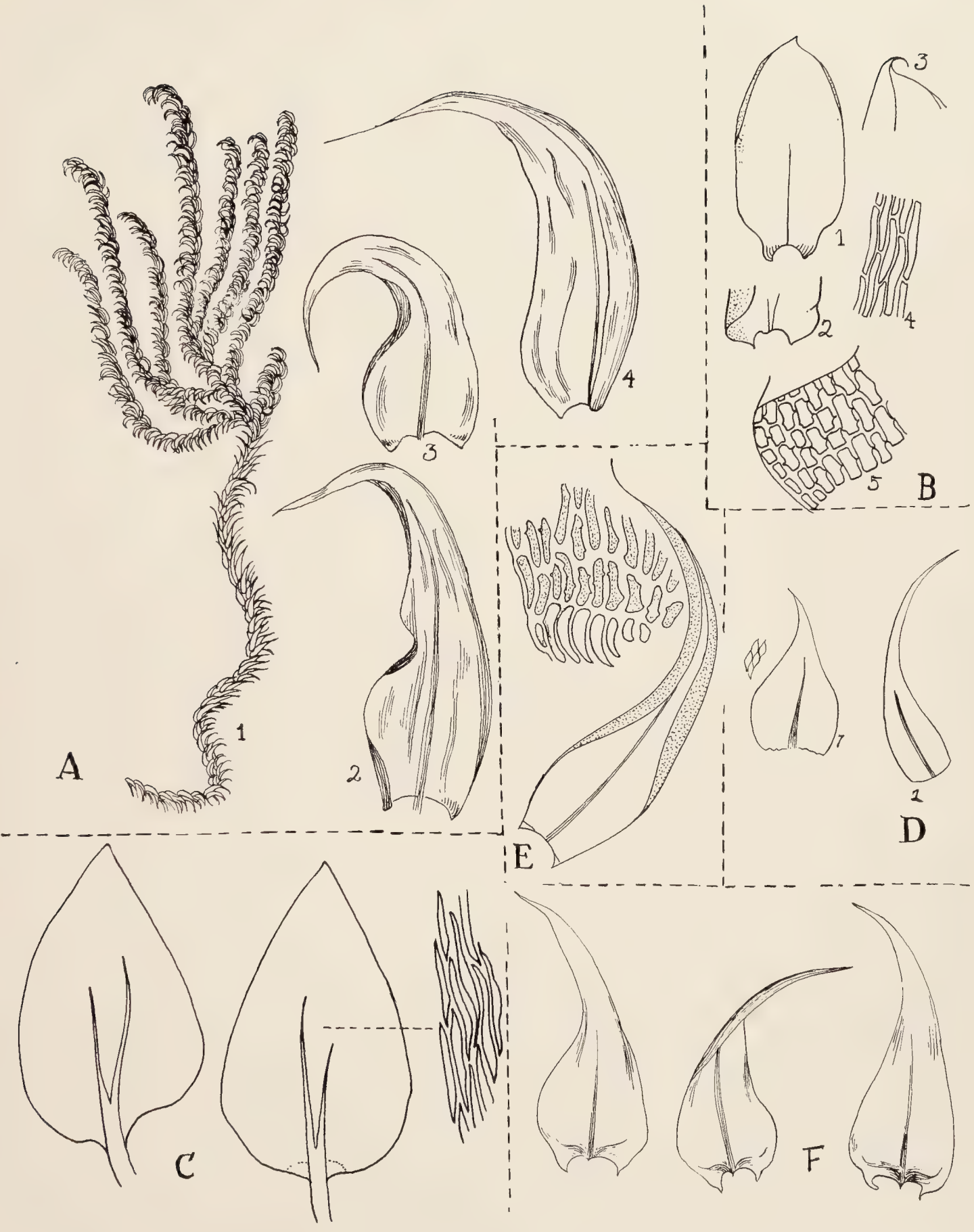


PLATE XXVI.

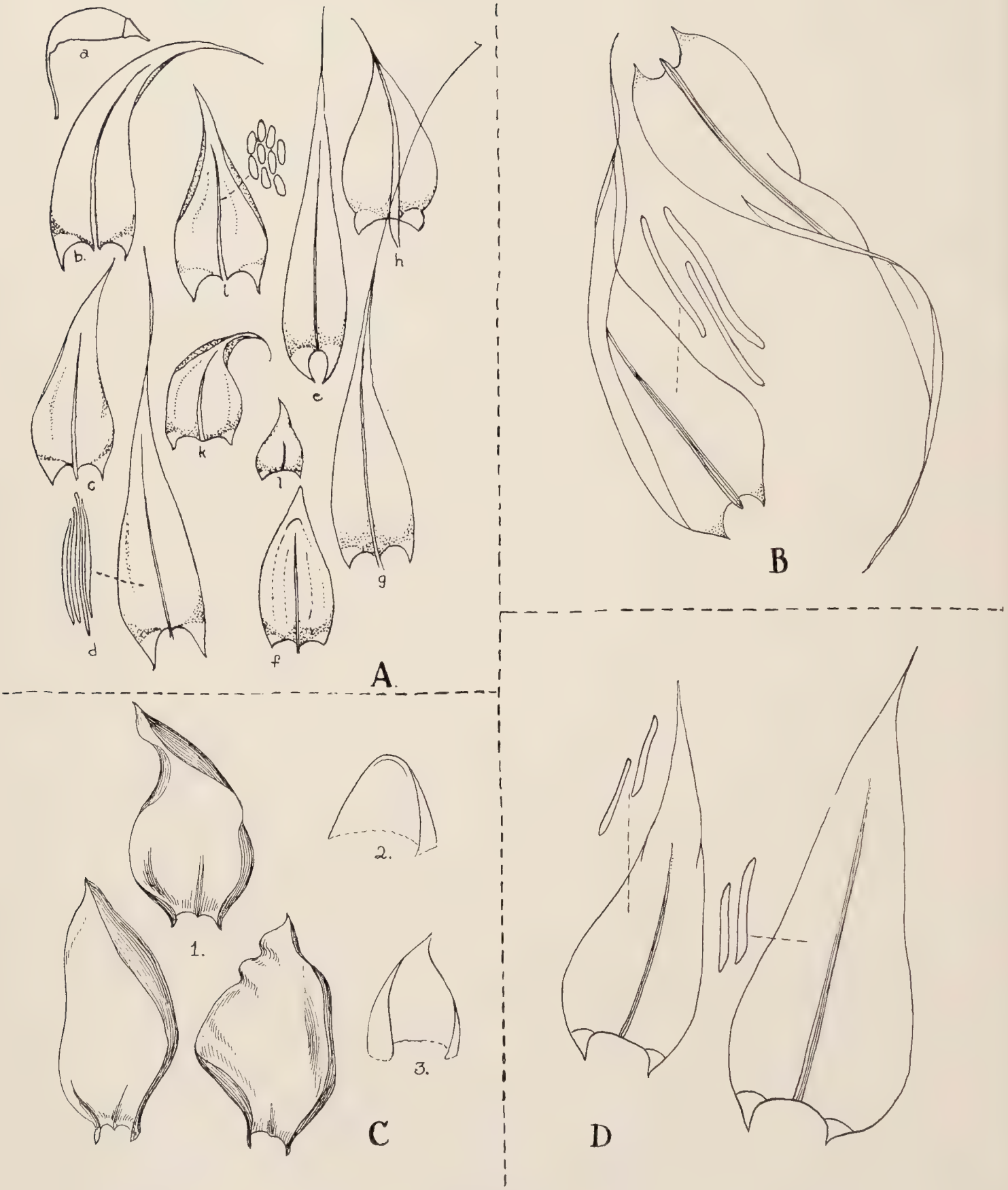


PLATE XXVII.

PLATE 27. *A*. (from Moenkemeyer in Pascher, Suesswasserfl. **14:** fig. 47). *a*, capsule of *Drepanocladus aduncus* × 4; *b*, leaf of the same enlarged; *c*, leaf of var. *Kneiffii; d*, leaf of f. *aquaticus* with a few median cells greatly enlarged; *e*, leaf of var. *pseudofluitans; f*, leaf of f. *pungens; g*, a leaf of the *capillifolius* form of f. *aquaticus; i*, leaf of var. *polycarpus; h*, leaf of *capillifolius* form of var. *polycarpus; k*, leaf of var. *polycarpus gracilescens; l*, leaf of var. *polycarpus gracilescens tenuis.*

B. Two leaves and median leaf cells, much enlarged, of *Drepanocladus aduncus* f. *aquaticus* (from Husnot, Musc. Gall. *pl. 105*).

C. Three leaves and two leaf apices of *Scorpidium scorpioides*, much enlarged (from Bry. Eur. *pl. 612*).

D. Two leaves of *Drepanocladus aduncus Kneiffii* f. *intermedius* (from Husnot, Musc. Gall. *pl. 106*).

PLATE 28. *A. Drepanocladus aduncus polycarpus* f. *gracilescens* (from Bry. Eur. *pl. 605B*). 1, plant × 1; figs. 2–7, stem leaves; 8 and 9, branch leaves; 1*b*, portion of plant enlarged; × 5*a* and 5*b*, cells of leaf apex and base respectively.

B. Drepanocladus revolvens (from Bry. Eur. *pl. 601*). Figs. 3 and 4, stem leaves; 5 and 6, branch leaves; 4*b*, areolation of the lower portion of the leaf.

PLATE XXVIII.

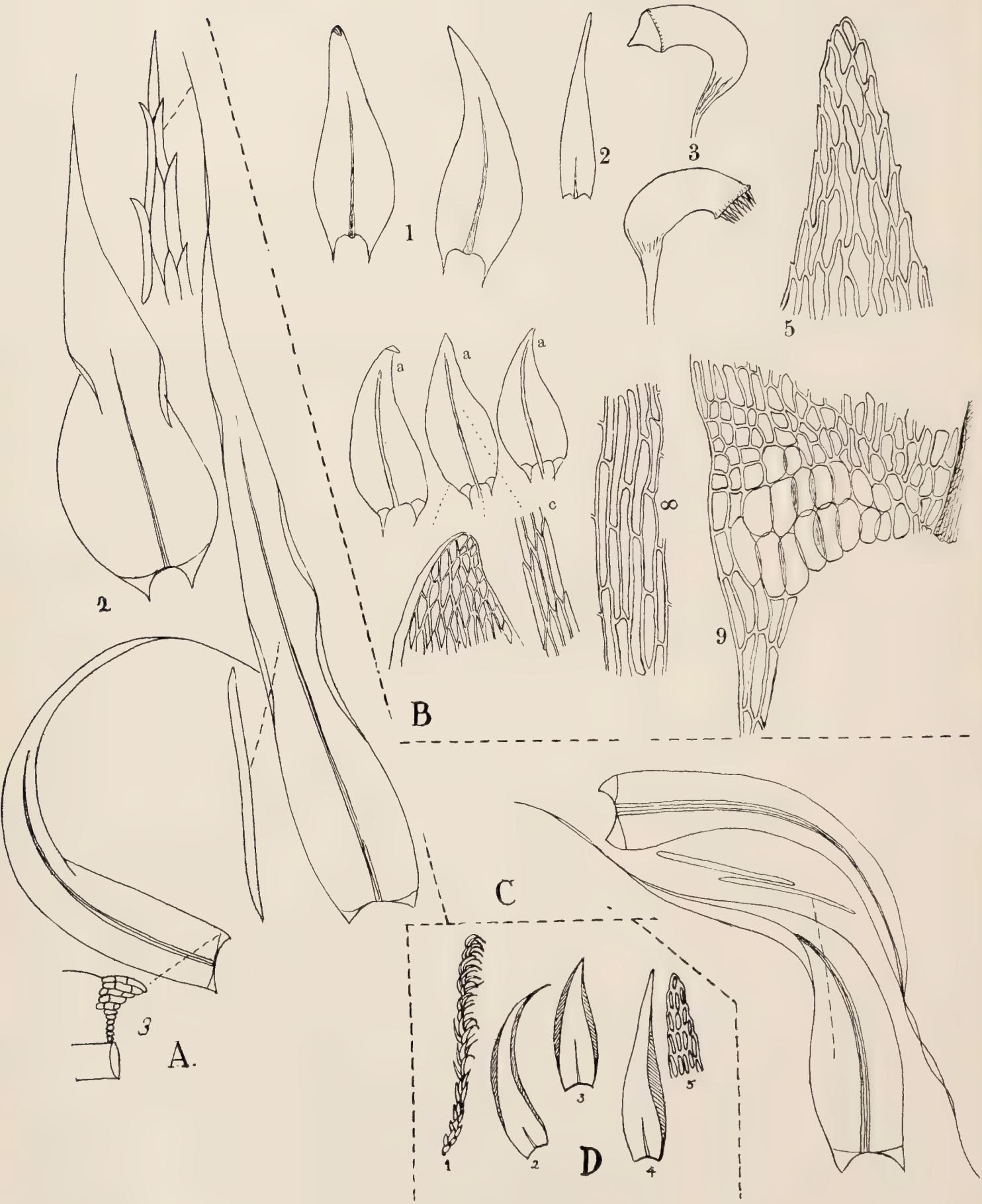


PLATE XXIX.

PLATE 29. *B. Drepanocladus exannulatus brachydictyus* f. *tundrae* (figs. 1–9 from Bull. N. Y. Bot. Gard. **2**: *pl. 24*, as *Harpidium amblyphyllum* Williams). 1, stem leaves × 12; 2, branch leaf × 12; 3, capsules × 10; 5, 8, 9, cells from apex, middle and base of leaf respectively × 285. Figs. *a–d* (from Bryologist **4**: *pl. 7*). *a*, *a*, *a*, stem leaves × 16; *c*, median and apical cells × 200.

A. Drepanocladus fluitans (from Husnot, Musc. Gall. *pl. 109*). Fig. 1, leaf and leaf cells of f. *setiformis;* 2, leaf of f. *submersus;* 3, leaf of a form of var. *falcatus* having rather long and slender leaves.

C. Stem leaves of *Drepanocladus exannulatus falcifolius* from Husnot, Musc. Gall. *pl. 111*.

D. Portion of stem × 4, stem leaves and leaf apex of *Drepanocladus Berggrenii* from Monkemeyer, Laubm. Europ. 779, *fig. 182*.

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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VOLUME III

Part 3

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Subfamily HYLOCOMIEAE.

Mostly large robust mosses growing in wide loose mats or patches, usually on soil or stones in cool moist woods; branching often regularly pinnate or bipinnate, giving the plants a fern-like appearance; central strand of few cells; paraphyllia abundant to entirely lacking. Leaves imbricate to squarrose-spreading (secund in *Rhytidium* and *Rhytidiopsis*); costa single or double and varying greatly in length and thickness, never percurrent or excurrent; median leaf cells linear, sometimes papillose on the back by the thickening of the angles of the cell walls as in *Bryhnia;* angular cells little differentiated to rounded-quadrate and numerous; cell walls often incrassate, especially at base of leaf, where they are often somewhat colored and pitted (porose). Mostly dioicous; seta long and smooth; capsules large, rather short, unsymmetric and cernuous, resembling those of *Brachythecium;* calyptra cucullate; peristome perfect, having well-developed cilia.

Key to Genera.

1. Paraphyllia lacking or very scarce ..... 2.
   Paraphyllia present and abundant ..... 3.
2. Leaves secund and strongly rugose, costa single, reaching middle of leaf or beyond ..... *1. Rhytidium.*
   Leaves spreading to squarrose, often plicate but not rugose; costa double, often strong ..... *3. Rhytidiadelphus.*
3. Leaves secund to falcate-secund, rugose; plants exclusively northwest American ..... *2. Rhytidiopsis.*
   Leaves loosely and regularly imbricate to squarrose-recurved, not rugose, rarely secund ..... *4. Hylocomium.*

1. RHYTIDIUM (Sull.) Kindb. Laubm. Schwed. und. Norw. 15. 1883.

Hypnum, subgenus *Rhytidium* Sull. Musc. & Hepat. U. S. 75. 1856.

Very robust, leafy stems often 4 mm. thick, irregularly divided and little branched to almost regularly pinnate; the *falcate-secund leaves more or less hooked at the ends of the stem and branches;* costa simple, reaching the middle of the leaf; paraphyllia lacking; pseudo-paraphyllia at axils of branches. Only one species known.

Rhytidium rugosum (Ehrh., Hedw.) Kindb. l. c.

Hypnum rugosum Ehrh. Dec. no. 291. 1793 and Hedw. Spec. Musc. 293, 1801.
Hylocomium rugosum DeNot. Epil. Bry. Ital. 99. 1869.

Plants in rather loose wide mats, yellow-green, often glossy; stems reaching about 12 cm. in length; ascending to erect; *pseudoparaphyllia found only in the axils of the branches; stem leaves crowded-imbricate, ovate-lanceolate, rather slenderly acuminate, reaching 3–5 x 1.5 mm., somewhat decurrent, plicate, *strongly rugose and secund; margin narrowly reflexed*, denticulate, especially above; leaf cells incrassate, *papillose on the back from the angles with strong forwardly directed papillae*, linear-flexuose, 6–8 μ wide, 8–10 : 1; *smaller, rounded-quadrate cells with thicker walls very numerous at the basal angles;* all basal cells shorter, subrectangular, thicker-walled and pitted, often colored; branch leaves smaller, less secund and less rugose. Dioicous; seta 2.5–5 cm. long; capsules strongly unsymmetric and cernuous, about 4 x 1 mm.; annulus of 3 rows of cells; operculum convex-apiculate to short-rostrate; spores in summer. Sporophytes found in Colorado and the Klondike only. Type locality European.

Illustrations:—Bry. Eur. *pl. 610;* M.H.M., *f. 143.*

Exsiccati:—Drumm. Musc. Am. 198; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 326, (Ed. 2) 485; Aust. Musc. Appal. 450; Grout, N. Am. Musc. Pl. 26; R. & C. Musc. Am. Sept. Exsic. 200; Bartram, Mosses of S. Arizona 151.

On soil and ledges in comparatively dry and sunny places, more or less calcicolous.

Northern U. S. and Canada across the continent, south to N. Carolina, Arizona and New Mexico.

A very distinct and striking plant, easily recognized in spite of its variations by its thick stems and secund rugose leaves. *Antitrichia curtipendula* sometimes bears a striking resemblance to this species in leaf structure except that its leaves are not rugose and the costa is divided.

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* *Pseudo-paraphyllia*, filaments or other growths not homologous with paraphyllia; apparently the first outgrowths that appear where a branch is to grow are so classed.

2. RHYTIDIOPSIS Broth. Engler & Prantl, Musci (Ed. 1) 1057. 1908.

This genus resembles Rhytidium strongly and was put in the same subgenus by Sullivant and by Lesq. & James. It differs chiefly in the abundant filamentose branching paraphyllia and double costa.

Rhytidiopsis robusta (Hook.) Broth. l. c.

Hylocomium robustum (Hook.) Kindb. Cat. Can. Pl. **6**: 250. 1892.
Hypnum Flemingii Aust. Bull. Torr. Bot. Club **5**: 24. 1896.
Hypnum robustum Hook. Musc. Exot. *pl. 108.* 1820.

Plants robust, in rather wide loose masses, yellow-green above, brown below; primary stems creeping at base, ascending to erect above, sparingly divided or branching; stems and branches curved at the ends by reason of the strongly falcate-secund terminal leaves; leaves crowded, imbricate, secund, *plicate and transversely rugose,* concave, ovate-lanceolate, rather slenderly acuminate, 6–8 x 2–3 mm., somewhat rounded and narrowed to the insertion; margin plane or slightly involute at base, sharply dentate above, nearly entire at base; *costa double, stout, one limb usually longer and often reaching nearly to the middle of the leaf;* leaf cells incrassate and porose, the median narrowly linear-flexuose, 6–8 μ wide, about 12 : 1; basal shorter, broader, thicker-walled, and often somewhat colored; *angular cells little differentiated,* a few somewhat shorter and broader than the other basal cells; perichaetial leaves rather scarious and reflexed, slenderly long-acuminate, the inner spinose-dentate above, with costa thin or almost wanting. Seta 4 cm. or less in length; capsule oblong to oblong-cylindric, cernuous and arcuate when dry; urn about 3 mm. long, 3 : 1; operculum conic, papillose; spores in autumn.

Type locality, western N. America, Menzies.
Illustrations:—Hook. l. c.; Engler & Prantl (Ed. 2) **2**: 478, *f. 761, A–D; Pl. 30 A.*
Exsiccati:—Drumm. Musc. Am. 199; Allen, Mosses Cascade Mts. 118; Grout, N. Am. Musc. Pl. 65; Macoun, Can. Musc. 342.
On the ground in woods, alt. 500–7000 ft., Rocky Mts. and westward in the northern U. S. and Canada, east to Montana.

3. RHYTIDIADELPHUS (Lindb.) Warnst. Laubm. Krypt.-Fl. Mark. Brand. 842. 1906.

Hylocomium, subgenus C, *Rhytidiadelphus* Lindb. Musc. Scand. 37. 1879.

Robust rigid plants growing in loose wide tufts or mats, often mixed with other hypnaceous mosses; stems elongated, prostrate below, ascending to erect above, simple or irregularly divided, variously branched; pseudo-paraphyllia found only in the axils of the branches; leaves more or less crowded, the upper half spreading to squarrose-recurved, occasionally somewhat secund, more or less plicate; costa double, ⅔ the length of the leaf, or sometimes almost lacking; median leaf cells narrowly linear, sometimes papillose by the thickening of the upper corners; angular cells in most species little differentiated; dioicous; seta smooth; capsule unsymmetric cernuous; peristome perfect; operculum conic.

Type species, *R. squarrosus* (L., Hedw.) Warnst.

Key.

1. Stem leaves spinose-papillose on the back, short-acuminate ..... 3. *triquetrus*
   Stem leaves smooth at back, slenderly acuminate ..... 2.
2. Stem leaves abruptly squarrose-recurved from the middle, scarcely plicate (except in var. *calvescens*) ..... 1. *squarrosus.*
   Stem leaves mostly secund, strongly plicate ..... 2. *loreus.*

1. Rhytidiadelphus squarrosus (L., Hedw.) Warnst. l. c. 918.

Hypnum squarrosum L. Sp. Pl. 1693. 1753; Hedw. Sp. Musc. 281. 1801.
Hylocomium squarrosum Bry. Eur. fasc. 49–51. *pl. 492.* 1852.

Plants green to yellow green, whitish below, soft for the genus; stems reaching 15 cm. or more in length, usually prostrate at base and ascending to erect above, more slender and flexuose than in the other two species, red below; central strand of few cells, or lacking; branches numerous, mostly short, slender and attenuate; stem leaves more or less crowded, imbricate, not secund, from *an erect-sheathing cordate-ovate base abruptly recurved-squarrose and ending in a long slender channeled acumination,* reaching 4 x 1.5 mm. or longer, *spreading at ends of stems making them stellate-obtuse, not plicate,* finely denticulate on the plane

margin, especially above, *not papillose;* costa comparatively short, double, scarcely reaching the middle of the leaf, or sometimes lacking; median *leaf cells thin-walled*, linear, 7–8 μ wide, 6–10 : 1; angular shorter and broader, *rectangular-hexagonal, very numerous, often colored or opaque*, forming large distinct but poorly delimited angular patches; branch leaves smaller, narrower and less squarrose. Dioicous; seta 2.5–3.5 cm. long; capsule red-brown, short, ovoid, unsymmetric; operculum conic-apiculate; annulus of 2 to 3 rows of cells; spores winter to spring.

Type locality European.

Illustrations:—Bry. Eur. l. c.; M. H. M. 268, *f. 142.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 282, (Ed. 2) 416; Aust. Musc. Appal. Suppl. 550; Grout, N. Am. Musc. Pl. 2 & 284; Allen, Mosses Cascade Mts. 123; Macoun, Can. Musc. 370.

On logs, soil and rocks in moist cool shady places; alt. from near sea level to 5000 feet. Northern U. S. and Canada across the continent, south to Pennsylvania and Tennessee. Often in shaded swampy places among grasses and sedges. Frequent in the mountains of New England, the Pacific slope of the U. S. and northwards.

North American plants of this species are much more variable than descriptions indicate. The plants may be almost as robust as *R. loreus* or slender and delicate as *Eurhynchium strigosum* when growing in shady grassy places. These slender forms often have bright red stems, leaves rather distant; stem leaves cordate-triangular and less recurved; the branch leaves abruptly short-acuminate to acute, with apices twisted or contorted; alar cells more differentiated with a much larger area of shorter and broader angular cells; branched or regularly pinnate.

This composite description of variations found in the *slender* forms is much like that given by Dixon for the var. *calvescens*, except that that variety is described as "more robust." I doubt if we have any forms properly referred to that variety and the variations enumerated above are not well enough correlated in the different plants studied to warrant naming forms or varieties. The blunt stellate ends of the leafy stems is characteristic of nearly all the forms, making them fairly easy to identify. In the next species the short newly developing stems are sometimes somewhat stellate at the ends but the older stems are more or less hooked by the secund leaves.

2. Rhytidiadelphus loreus (L., Hedw.) Warnst. l. c. 922.

Hylocomium loreum Bry. Eur. *pl. 490.*

Hypnum loreum L. Sp. Pl. 1127. 1753, and Hedw. Sp. Musc. 294. 1801.

Plants in loose intertangled mats, yellowish to gray-green; stems 10–20 cm. long, sparingly divided, flexuose, prostrate to ascending below, nearly erect above and usually somewhat hooked at the ends by the falcate-secund leaves, sometimes bright red, irregularly to subpinnately branching with numerous attenuate branches, which are often strongly stoloniferous at the ends; central strand not apparent; stem leaves sheathing at base, imbricate, more or less falcate-secund, strongly plicate, 3–5 x 1.2–1.7 mm., from a broadly ovate or ovate-oblong base rather abruptly or gradually narrowed to a long slender channeled and strongly recurved acumination; margins plane, finely denticulate; costa short and double or almost lacking; median leaf cells narrowly linear, about 7 μ wide, 8–12 : 1, occasionally longer, smooth; basal cells broader, shorter and thicker-walled, often colored; *alar cells scarcely differentiated;* branch leaves smaller and narrower. Dioicous; seta 2–4 cm. long; capsule short and thick, oblong-ovoid, unsymmetric and cernuous, 2–3 mm. long, about 2 : 1, slightly plicate when dry and empty; annulus of two rows of cells; operculum conic, long-apiculate; spores in spring.

Type locality European.

Illustrations:—Bry. Eur. l. c.; *Pl. 30, C.*

Exsiccati:—Drumm. Musc. Am. 181; Allen, Mosses Cascade Mts. 125; Grout, N. Am. Musc. Pl. 6; R. & C. Musc. Am. Sept. Exsic. 348; Macoun Can. Musc. 372.

This resembles *R. squarrosus* in many ways but is easily differentiated in the field by the strongly plicate stem leaves which are also hooked at the stem-ends.

On soil, rocks and decayed wood, chiefly in moist subalpine forests. Northwestern U. S., and western Canada northwards, south to Oregon and Ontario, east to Newfoundland and Nova Scotia.

3. Rhytidiadelphus triquetrus (L., Hedw.) Warnst. l. c. 920.

Hypnum triquetrum L. Sp. Pl. 1124. 1753 and Hedw. Sp. Musc. 256. 1801.

Hylocomium triquetrum Bry. Eur. fasc. 49–52. *pl. 491.* 1852.

Plants very robust, in large thick loosely intertangled mats or patches, bright to yellowish green; *stems stout, stiff but elastic,* inclined at base or entirely erect, 5–15 cm. or more in length, sparingly divided or simple; central strand few-celled; pseudo-paraphyllia in the branch-axils, *branching irregular and unequal*

or sometimes regular and equal but not complanate-pinnate; branches mostly attenuate; stem leaves averaging the largest of the genus, reaching 5 mm. or more in length, about 2 : 1, *widely spreading wet or dry, when moist almost squarrose,* rarely secund, *stiff and scarious, cordate-triangular, rounded auriculate at the basal angles and narrowed to the insertion, somewhat decurrent,* gradually narrowed above to a rather broad acumination, strongly plicate, denticulate nearly to the base, sharply dentate above; *costa double with strong parallel limbs, often reaching ¾ the length of the leaf;* median leaf cells linear, 6–7 μ wide, 6–10 : 1, rather thick walled; *upper spinose-papillose on the back by projecting cell angles;* lower and basal broader, shorter, hexagonal-oblong to rectangular, thicker-walled and pitted, a few at the extreme angles nearly as broad as long and often somewhat thinner-walled and slightly swollen. Dioicous; seta 3–4 mm. long; capsule oblong, unsymmetric, cernous to horizontal, 3–4 x 1–1.5 mm., smooth or widely striate when dry and empty; operculum acutely conic-apiculate, almost rostellate; annulus of 2–3 rows of cells; spores December to spring.

Type locality European, probably English.

Illustrations:—Bry. Eur. l. c.; Jennings, Mosses W. Pa. *pl. 43*; M. H. M. 267, *f. 141; Pl. 30.*

Exsiccati:—Drumm. Musc. Am. 182; Sull & Lesq. Musc. Bor. Am. (Ed. 1) 283, (Ed. 2) 417; Aust. Musc. Appal. 449; Allen, Mosses Cascade Mts. 124; Grout, N. Am. Musc. Pl. 64, Musci Perfecti 32; R. & C. Musc. Am. Sept. Exsic. 349; Macoun, Can. Musc. 371.

On the ground in rather moist and shaded places. Northern U. S. and Canada across the continent and northwards; south to N. Carolina, Missouri and California.

Common in mountainous and subalpine regions.

Var. beringianus (Card. & Thér.) Grout, Ck. List 18. 1929.

Hylocomium Card. & Thér. Proc. Wash. Acad. Sci. **4**: 346. 1902.

Leaves yellowish, erect-imbricate to appressed-imbricate when dry; a few, especially at the stem ends somewhat secund. Type from Hall Island, Behring Sea, July 14, 1899 (Trelease 1989). Type seen and studied.

The original description says of the leaves "less papillose" but the leaves on the portion of the type studied were little different in this respect.

Also known from Blue Fox Island, Alaska, Mrs. M. B. Streeter; Kootenai Mts., Flathead Co., Montana, T. A. Bonser (Det. E. G. B.).

An arctic-alpine variation, little branched to almost simple in the plants seen and of a very different appearance from the type.

Var. *californicus* (R. & C.) Grout, l. c. (*Hylocomium* R. & C. Bot. Gaz. **15**: 61. 1890) is merely a very robust form with rugose undulate leaves.

4. HYLOCOMIUM Bry. Eur. fasc. 49–52. 1852.

Robust mosses of cool elevated regions. Stems stiff, bearing numerous filiform branching paraphyllia; branching irregularly pinnate to regularly bi- tri-pinnate; leaves broadly ovate-cordate to oblong, usually acuminate, concave; costa double (except in most forms of *H. pyrenaicum*), short or reaching to the leaf middle. Dioicous; capsule ovoid to oblong, unsymmetric and cernuous; peristome perfect.

Type species, *H. splendens.*

Key.

1.	Costa single, extending to the leaf middle, rarely forking	*4. pyrenaicum.*
	Costa double, usually not reaching middle of leaf	2.
2.	Stem leaves rounded-obtuse	*2. alaskanum.*
	Stem leaves acute or acuminate	3.
3.	Stems closely and regularly bi- tri-pinnate	*1. splendens.*
	Stems branching irregularly, or irregularly pinnate	4.
4.	Stem leaves decurrent and coarsely toothed at base	*3. umbratum.*
	Stem leaves rounded-cordate at base and finely toothed	*5. brevirostre.*

1. Hylocomium splendens (Hedw.) Bry. Eur. l. c. *pl. 487.*

Hypnum splendens Hedw. Sp. Musc. 262. *pl. 67, figs. 7–9.* 1801.

Hypnum proliferum L. Sp. Pl. 1125. 1753.

Plants robust, in wide loose patches, yellow-green to olive, brown below, stiff, more or less procumbent, reaching 20 cm. or more in length, usually shorter, *consisting of arched ascending annual innovations arising from near the middle of the preceding year's growth, each seasons growth regularly bi- tri-pinnate and fern-like*

in appearance, resembling a large Thuidium; central strand lacking; median branches 15–20 mm. long; branches and branchlets attenuate; *paraphyllia much branched with capillary divisions, numerous on the main stems and branches,* smaller and fewer on the branchlets; leaves at the base of the annual innovations scale-like, closely appressed; stem leaves loosely imbricate, broadly ovate, scarcely decurrent, *abruptly narrowed to a flexuose acumination of varying length,* 2–3 mm. long, about 2: 1, concave, lightly plicate, *somewhat transversely rugose toward the apex,* more or less *spinose-papillose on the back by projecting cell angles,* strongly serrate above; basal margin recurved; *costa double, usually short* but occasionally reaching nearly ½ the length of the leaf; median leaf cells linear-flexuose, rather blunt at ends, about 6 μ wide, 7–10: 1 ; basal cells shorter, broader and incrassate, colored and pitted; *alar scarcely different;* leaves of branches smaller, abruptly acute to acuminate, concave, not plicate; leaves of branchlets about 0.6 x 0.24 mm., *gradually obtusely acute, margins incurved* and more or less serrulate above. Dioicous; antheridia borne on the branches; archegonia on the main stems; seta 1.5–2.5 mm. long, light- to red-brown; capsule 3.5–5 mm. long including the beaked operculum, 1–1.5 mm. thick, light to dark brown, ovoid to oblong, unsymmetric, nearly or quite horizontal, slightly contracted under the mouth when dry and empty; annulus present; peristome perfect; spores in spring. Type locality European.

Illustrations:—Bry. Eur. l. c.; Hedw. l. c.; Jennings, Mosses Western Pa. *pl. 43;* M. H. M. 265; *f. 140.* Mosses with H-lens (Ed. 3) *pl. 53; Pl. 31.*

Exsiccati:—Sull. Musc. Allegh. 1; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 285; Aust. Musc. Appal. 447; Drumm. Musc. Am. 218; Grout, N. Am. Musc. Pl. 42, Perfecti 94; Allen, Mosses Cascade Mts. 122.

Northern U. S. and Canada across the continent and northwards, south to N. Carolina, S. Dakota, Colorado and California!

On ledges, humus and decaying wood in cool moist ravines and mountain woods from sea level to 10,000 ft.

Early in the season the new shoots are simply pinnate and very characteristic, later they become bi-tri-pinnate with the Thuidium-like facies. Slender simply pinnate forms occur when the plants are crowded in among other plants. In dry exposed places the plants become reduced, sometimes more compact, resembling *Calliergonella Schreberi,* at other times slender and simply pinnate (=var. *gracilius* Boul.). *H. umbratum* is the only species likely to be mistaken for *splendens* but in *umbratum* the branching is in most cases much less regularly pinnate, and bushy instead of complanate; also the branches are more slenderly attenuate and paraphyllia very numerous even on the branchlets. R. S. Williams collected in Yukon Terr. a long slender bipinnate form reaching 15 x 2 cm. that has no apparent innovations.

2. Hylocomium alaskanum (Lesq. & James) Kindb. Cat. Can. Pl. **6**: 248. 1892.

Hypnum alaskanum Lesq. & James Man. 405. 1884.

Resembling small forms of *Calliergonella Schreberi* but with stems bearing abundant paraphyllia; leaves minutely serrulate all around with very small teeth; margins flat above and strongly reflexed near the base; leaves concave, not plicate; leaf cells linear-flexuose, scarcely or very slightly pitted; basal cells golden-brown, alar scarcely differentiated; costa short and double.

Illustration:—Bryologist, *22:* 1. *fig. 1.* 1919; *Pl. 31 A.*

Alaska and British Columbia.

As there is a series of intergrading forms progressively approaching the Dall type as we go farther north, it seems best to treat *H. alaskanum* as an arctic subspecies of *H. splendens,* of which it is certainly a derivative. Specimens from different Alaskan localities identified by Williams have in some cases apiculate to acuminate stem leaves.

A Muir Glacier plant and other far northern forms of *splendens* have all the leaves of branches and branchlets more abruptly rounded at apex, much as shown in Williams' figures, but the stem leaves still have a short acumination which is more like a large apiculus than the acumination ordinarily found in *H. splendens.* The leaves are also relatively broader.

Limpricht makes *H. alaskanum* a variety of *splendens* and says of it "einfach gefiedert," but specimens of Dall's Alaskan collection (presumably from the type collection) from the James herbarium, now in the collections of the New York Botanical Garden, are twice pinnate. The branchlets have very few paraphyllia and the branch leaves occasionally have a few papillae on the back above.

3. Hylocomium umbratum (Ehrh., Hedw.) Bry. Eur. fasc. 49–51, *pl. 488.* 1852.

Hypnum umbratum Ehrh. 1788 and Hedw. Sp. Musc. 263, *pl. 67, figs. 10–13.* 1801.

Plants with somewhat the habit of *H. splendens* but with the *serial innovations less apparent,* growing in loose irregular patches, dark green, brownish below, 15–20 cm. in length; *annual innovations arched, rather irregularly pinnate or bipinnate but not in one plane, giving the plants a bushy appearance; branches* and *branchlets attenuate;* stems reddish; central strand lacking; paraphyllia numerous on stems and *branches,*

rather broader at base than in *H. splendens;* stem leaves not crowded, often rather distant, somewhat spreading when moist, *triangular-cordate, longly and narrowly decurrent,* slenderly acute to long-acuminate, reaching 2 mm. long by 1.5 mm. broad, usually smaller, deeply and irregularly plicate; margin wavy and *serrate with very strong unequal teeth, which may be spreading or even recurved;* costa double, strong, reaching the middle of the leaf or even farther, often bearing one or more spines on the back; *leaf cells not papillose at back,* median linear-flexuose to linear-oblong, about 6 μ wide, 6–10 : 1, basal shorter and broader, often colored, *alar not differentiated;* branch leaves smaller; leaves of *branchlets ovate-lanceolate, more slenderly acuminate, with a much longer costa, one branch often reaching ¾–⅘ the length of the leaf;* perichaetial leaves squarrose-recurved at tips. Dioicous; antheridia on branches, archegonia on stems; seta 2.5–3.5 mm. long; capsule chestnut, ovoid, unsymmetric, nearly horizontal, 3–3.5 mm. long including operculum; operculum conic; "annulus lacking"; spores winter to early spring, rarely produced. Type locality European.

Illustrations:—Bry. Eur. l. c.; M. H. M. *pl. 71.*

Exciccati:—Sull. Musc. Allegh. 2; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 286; (Ed. 2) 420; Aust. Musc. Appal. 548; Grout, N. Am. Musc. Pl. 41; Macoun, Can. Musc. 368.

On stones, old logs and humus in moist shaded places in mountain woods or cold ravines; northeastern U. S. and eastern Canada, south in the mountains to N. Carolina and west to Ohio, Ontario and Alaska. Often confused with *H. splendens.* For distinctions see under that species. (In M. H. M. p. 267 the leaves are described as papillose on the back, by an accidental dropping of the word "not").

On the summit of Mt. Mansfield, Vt., and probably elsewhere, is found a condensed compact form closely corresponding to forma *alpina* R. & C., Musc. Eur. Exsic. 250. I regard this as simply an alpine habitat form.

4. Hylocomium pyrenaicum (Spruce) Lindb. Musc. Scand. 37. 1879.

Hypnum pyrenaicum Spruce, Musc. Pyren. no. 4. 1879.
Hypnum Oakesii Sull. Mosses U. S. 673. 1848.
Hypnum fimbriatum Hartm. Scand. Fl. (Ed. 5) 330. 1849, and Bry. Eur. fasc. 49–51. *pl. 489.* 1852.

Plants robust, in rather thin loose mats, dark to yellowish-green, paler at stem and branch tips; stems procumbent with ascending, sparingly and *irregularly branched secondary stems,* reddish-brown, *densely covered with much branched (often bipinnate) paraphyllia* which are often attached to the base of the costa; terminal portions of stems and branches turgid with the loosely erect-spreading subscariose leaves; median stem leaves broadly ovate, narrowed at base, sometimes slightly decurrent, acute to broadly short-acuminate, about 2.5 mm. long, 2 : 1; *costa single, reaching about ½ the length of the leaf;* some lower leaves oblong, acute, with a short double costa; upper stem leaves with a longer, more slender twisted acumination; lower leaves often barely serrulate, the upper spinose-serrate above; all very concave, *strongly plicate with margins recurved at base when dry,* branch leaves similar but smaller; leaf cells not papillose at back, otherwise much as in the other species or a little shorter; basal and apical shorter and broader; basal colored, thick-walled and pitted; alar little differentiated; perichaetial leaves abruptly narrowed to a long slender recurved serrate acumination. Dioicous; seta 1–3 cm. long; capsule ovoid, unsymmetric, cernuous, 2.5–3 mm. long including the conic-apiculate operculum, about 2 : 1; annulus lacking; spores winter to early spring, rarely produced.

Type locality European.

Illustrations:—Bry. Eur. l. c.; Sull. Icon. Musc. *pl. 102; Pl. 31B.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 287, (Ed. 2) 421; Aust. Musc. Appal. Suppl. 549; Grout, N. Am. Musc. Pl. 146; Macoun, Can. Musc. 369.

On old logs and moist rocks in cool ravines or woods in mountains. Northeastern U. S., eastern Canada and northwards, south to Vermont and New Hampshire, west to Minnesota, Revelstoke, B. C., and the Yukon. Infrequent and local. (See Bryologist **14:** 9 for an account of a freak form.)

5. Hylocomium brevirostre (Ehrh., P. B.), Bry. Eur. fasc. 49–51, *pl. 493.* 1852.

Hypnum brevirostrum Ehrh. Pl. Crypt. Exs. 85. 1788 and P. B. Prod. 61. 1805.

Plants in loose, dark green tufts, often yellowish above, stiff and robust, freely but irregularly branching, 5–15 cm. or more in length; stems reddish, *erect or arched, often subdendroid;* mature branches usually attenuate, young branches often stout, blunt and turgid; "central strand of a few thick-walled cells"; *paraphyllia abundant* but *more slender than in the preceding species, freely branched but mostly one cell in thickness except at base; lower stem leaves rather distant, squarrose-spreading, broadly triangular-ovate, auricled and clasping, plicate,* "slightly decurrent," abruptly narrowed to a rather slender *channeled contorted acumination,* 1.2–1.5 mm. long and nearly as wide; *margins plane or incurved at base of acumination, serrate above, serrulate nearly to base,* costa double, the longer branch often reaching beyond the leaf-middle; upper stem

leaves more crowded, erect-spreading when moist, more gradually long-acuminate, 2–3 mm. long, 1.5–2 mm. wide; costa double, rarely reaching more than ⅓ the length of the leaf; median leaf cells linear-flexuose, rather blunt, about 7 μ wide, 5–7 : 1, cell walls rather thick and slightly pitted; basal cells shorter, broader and *colored with thicker abundantly pitted cell walls; alar cells scarcely different;* branch leaves smaller, less squarrose; perichaetial leaves slenderly long-acuminate, squarrose-spreading when dry, "the inner ecostate." Dioicous; male buds on branches, archegonial on stems; seta 15–25 mm. long; capsule oblong-ovoid, unsymmetric, cernuous to horizontal, red-brown, 3–3.5 mm. long including operculum, *striate when dry; operculum conic-rostrate;* annulus present; spores winter to early spring. Type locality European.

Illustrations:—Bry Eur. l. c.; Jennings, Mosses W. Pa. *pl. 44; Pl. 31.*

Exsiccati:—Drumm. Musc. Am. (S. States) 135; Sull. Musc. Allegh. 8; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 284, (Ed. 2) 418; Small, Mosses S. States 44; Macoun, Can. Musc. 373; Grout, N. Am. Musc. Pl. 44 & 44a, Musci Perfecti 219.

On moist rocks and soil in cold shaded ravines or swamps, usually in the mountains.

Nova Scotia to Ontario, south to Georgia and Missouri, not reported west of Ontario or the Mississippi River.

Distinguished by its coarse stiff habit, slender paraphyllia and squarrose cordate-auriculate subclasping stem leaves. It is less alpine than *umbratum* and is often found in the same general localities as *splendens*. Short depauperate forms lacking the characteristic squarrose-recurved leaves and bearing young undeveloped branches are misleading.

Subfamily HYPNEAE.

Plants of varied habit and habitat, often regularly pinnate and plumose; central strand often lacking; paraphyllia often present; costa short and double or lacking; leaves secund to falcate-secund in the majority of species, but with numerous exceptions; leaf cells smooth (papillose at back in a few cases), rhomboidal to linear-flexuose but usually more than 3 : 1 (exceptions in some genera); margins mostly plane, or sometimes recurved at base; alar cells usually differentiated, either enlarged and inflated or smaller and subquadrate; urn of capsules usually more than 2 : 1; peristome usually with cilia except in some forms with erect capsules; outer basal plates of peristome teeth marked with fine transverse lines.

Key to Genera.

1.	Stem and branch leaves secund, often falcate	2.
	Stem leaves not falcate, rarely secund (except *Vesicularia* species)	7.
2.	Alar cells inflated, usually hyaline	3.
	Alar cells not inflated, often smaller and subquadrate	5.
3.	Operculum long-beaked	4.
	Operculum conic to short-rostrate	*1. Hypnum.*
4.	Leaves entire or slightly serrulate; exothecial cell walls collenchymatous	*4. Sematophyllum.*
	Leaves sharply serrate; exothecial walls not collenchymatous	*2. Brotherella.*
5.	Capsules erect and symmetric	6.
	Capsules unsymmetric to curved, cernuous; cilia present	*1. Hypnum.*
6.	Peristomes without cilia, or cilia short and vestigial; plants usually found on the bark of living trees	*7. Pylaisia.*
	Peristomes with cilia; plants usually growing on rotten wood, humus or soil	*1. Hypnum.*
7.	Alar cells inflated and hyaline	*3. Heterophyllum.*
	Alar cells not inflated, mostly smaller and subquadrate	8.
8.	Plants minute; leaves less than 0.8 mm. long	*6. Amblystegiella.*
	Plants larger; leaves 1 mm. or more in length	9.
9.	Leaves papillose on the back above	10.
	Leaves not papillose	11.
10.	Papillae at cell angles	*10. Mittenothamnium.*
	Papillae in the middle of the cells	*9. Taxithelium.*
11.	Quadrate alar cells numerous, small	12.
	Quadrate alar cells few or none	14.
12.	Capsules erect and symmetric; cilia lacking in the peristome	*8. Platygyrium.*
	Capsules unsymmetric and cernuous	13.

13. Plants short and compact, not filiform ..... *5. Homomallium.*
Plants slender, long-filiform, rare western ..... *11. Tripterocladium.*
14. Leaf cells hexagonal to elongated-hexagonal ..... *12. Vesicularia.*
Leaf cells linear-fusiform ..... *13. Ectropothecium.*

1. HYPNUM L., Hedw. Sp. Musc. 236. 1801.

Plants large to slender, usually in densely intertangled mats, bright- to yellowish-green, sometimes golden-green, often glossy; stems prostrate to ascending or erect, simple or divided; branching irregular to regularly complanate-pinnate; ends of stems and branches often hooked by the strongly falcate-secund leaves; central strand of few cells present in most species; *paraphyllia usually present, often broad and leaf-like; leaves falcate-secund, usually in two more or less regular rows with the points turned down* (exclusive of *H. Crista-castrensis*); *costa short and double or lacking; median leaf cells linear-flexuose,* smooth (except *H. molluscum*) differentiated alar cells present in most species, small and quadrate or inflated and hyaline. Capsules oblong to cylindric, erect to usually more or less inclined or horizontal, nearly symmetric to strongly curved; operculum conic to short-rostrate; peristome perfect, cilia usually well developed. Occurring on all kinds of substrata.

Type species *H. cupressiforme.*

Key.

1. Branching regularly pinnate ..... 2.
Branching irregular or very irregularly pinnate ..... 18.
2. Alar cells conspicuously inflated, hyaline and thin-walled ..... 3.
Alar cells little or not at all inflated, usually smaller and quadrate to rectangular ..... 5.
3. Stem leaves acute to broadly acuminate; capsules strongly plicate when dry and empty ..... *12. arcuatum.*
Stem leaves slenderly acuminate, often with filiform-acumination; capsules not plicate* ..... 4.
4. Leaves filiform-acuminate; stem leaves entire ..... *9. callichroum.*
Leaves slenderly acuminate; acumination not filiform, more or less serrulate above ..... *11. Dieckii.*
5. Most leaves quite entire ..... 6.
Most leaves distinctly serrate ..... 8.
6. Leaf base cordate-auriculate; plants very large ..... *23. procerrimum.*
Leaf base not cordate-auriculate (cordate but not auriculate in *subplicatile*); plants small to medium (for the genus) ..... 7.
7. Leaf margins strongly revolute to near apex ..... *19. revolutum.*
Leaf margins plane ..... *10. subplicatile.*
8. Leaf base cordate-auriculate, cells more or less distinctly papillose dorsally by projecting cell angles ..... *22. molluscum.*
Leaf base not cordate-auriculate, cells smooth ..... 9.
9. Leaves strongly plicate, with apices curved towards the next lower branch ..... *21. Crista-castrensis.*
Leaf apices curved towards the substratum; leaves very slightly or not at all plicate when moist ..... 10.
10. Cuticular (cortical) stem cells large, 8–12 μ in diameter, hyaline ..... 11.
Cuticular stem cells narrow ..... 12.
11. Plants small, cespitose; leaves rarely over 1 mm. long; capsules about 2.5 mm. long ..... *14. hamulosum.*
Plants medium sized to large; stem leaves over 1.5 mm. long; capsules 4–5 mm. long ..... *8. subimponens.*
12. Capsules long-cylindric, erect and symmetric or slightly curved and inclined ..... *1. imponens.*
Capsules ovoid to subcylindric, unsymmetric or curved, inclined to horizontal ..... 13.

* *H. imponens* may be sought here.

13. Quadrate alar cells very numerous (6–10 along the margin)..... 14.
Quadrate alar cells few or lacking..... 15.
14. Leaves usually nearly entire, with a few larger cells at extreme basal angles; dioicous..... *2. cupressiforme.*
Leaves strongly serrate, with no enlarged alar cells; monoicous..... *17. reptile.*
15. Capsules strongly plicate when dry..... *4. curvifolium.*
Capsules not plicate (very rarely slightly wrinkled)..... 16.
16. Capsules 3 mm. or more long, sometimes wrinkled..... *5. fertile.*
Capsules small, smooth, including operculum 2 mm. long (or even less). 17.
17. Leaves not much narrowed to the insertion; dioicous (reported from the eastern coast regions of Canada; doubtfully North American)..... *7. canariense.*
Leaves abruptly narrowed and rounded to the insertion; monoicous; plants of the Pacific slope..... *6. circinale.*
18. Alar cells enlarged, inflated and hyaline; cuticular stem cells large and hyaline.*..... 19.
Alar, and cortical stem cells not as above..... 21.
19. Plants with leaves strongly falcate-secund in two rows, with the habit of *cupressiforme*..... *12. arcuatum.*
Plants complanate-foliate, with the habit of a *Plagiothecium*..... 20.
20. Inflated alar cells abruptly enlarged, sharply delimited..... *12. arcuatum var. demissum.*
Alar cells gradually enlarged and not sharply delimited..... *13. pratense.*
21. Leaves nearly or quite entire; plants arctic-alpine, calcicolous..... 22.
Leaves serrulate or denticulate, at least above..... 23.
Leaves entire or serrulate at base only..... *20. geminum.*
22. Plants robust; leaves 1.5 mm. long..... *15. Bambergeri.*
Plants slender; leaves less than 1 mm. long..... *16. fastigiatum.*
23. Quadrate alar cells very numerous, 6–15 in the marginal row..... 24.
Quadrate alar cells comparatively few, less than 6 in the marginal row. *18. pallescens.*
24. Leaves serrulate nearly or quite to base..... *17. reptile.*
Leaves serrulate at apex only, some often entire..... 25.
25. Median leaf cells 10–15 : 1; quadrate alar cells 6–10 in the marginal row.† *2. cupressiforme.*
Median leaf cells 4–6 : 1; quadrate alar cells 12–15 in marginal row.... *3. Vaucheri.*

Subgenus STEREODON Mitt. Journ. Linn Soc. **12**: 22. 1869.

Plants irregularly to pinnately branched, often so regularly branched as to have a frond-like appearance; leaves (with few exceptions) strongly falcate-secund, turned towards the substratum; leaf cells smooth.

1. HYPNUM IMPONENS Hedw. Sp. Musc. 290. *pl. 77, figs. 1–5.* 1801.

Plants in rather thin closely intertangled mats, rarely in thick cushions, dark to yellow-green above, brownish below; stems reaching 10 cm. in length, *stiff, red* to red-brown, prostrate, *rather regularly and complanately branching; paraphyllia numerous for the genus, broad, often ciliate;* stem leaves little or not at all decurrent, *broadly triangular-oblong,* rather gradually narrowed *to a slender serrate acumination,* narrowed and somewhat rounded to the insertion, strongly falcate-secund to circinate, curving down, concave, occasionally slightly wrinkled, about 2 x 0.6 mm., occasionally larger; margins plane or slightly recurved at base, serrulate; costa lacking or very short and double; median leaf cells linear-flexuose, about 6 μ wide, 6–10 : 1; basal broader, incrassate and colored, often a bright orange-brown; a comparatively few alar cells small and quadrate, 4–6 along the margin, at the extreme angles a number (3–4 on the margin) of larger, slightly inflated cells, clear but usually colored, all incrassate and forming small but distinct auricles; branch leaves much smaller, narrower, lanceolate, with fewer quadrate alar cells; perichaetial leaves plicate. Dioicous; seta 1.5–3.5 cm. long; capsule cylindric, *nearly erect and symmetric or slightly curved,* chestnut-brown when old, including operculum *3–4 mm. long, 4–6 : 1;* operculum slenderly conic, long-apiculate to rostellate; annulus of 2–3 rows of cells; peristome perfect; spores autumn to early winter. Type locality European.

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* *H. callichroum* may be sought here.
† *H. revolutum* may be sought here.

ILLUSTRATIONS:—Bry. Eur. *pl. 597;* Jennings, Mosses W. Pa. *pl. 45;* M. H. M. 351 & 352, *figs. 184 & 185;* Mosses with a Hand-lens (Ed. 3) *pl. 57.*

EXSICCATI:—Drumm. Musc. Am. 205. (as *H. cupressiforme*); Sull. Musc. Allegh. 16; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 321, (Ed. 2) 475; Aust. Musc. Appal. 418; Grout, N. Am. Musc. Pl. 8, 287 (an alpine form) & 318; R. & C. Musc. Am. Sept. Exsic. 137.

On soil and rocks but chiefly on rotting wood in moist shaded places. Abundant from Canada to Georgia, westward to British Columbia and California. Apparently less frequent or lacking in the far North and West where its place seems to be taken by *H. subimponens*. When sterile, often difficult to distinguish from *fertile* and *cupressiforme*. The number of small quadrate cells above the inflated alar cells seems to vary a great deal on the same plant. This species and *H. cupressiforme* are closely related and often intergrade, especially in England.

2. HYPNUM CUPRESSIFORME L., Hedw. Sp. Musc. 291. 1801.

Stereodon complexus Mitt. Jour. Linn. Soc. **8**: 41. 1865.
Hypnum pseudofastigiatum C. M. & Kindb. Cat. Can. Pl. **6**: 235. 1892. Type seen.

Plants exceedingly polymorphous, often closely approaching *H. imponens* in appearance, but from this it differs in its lighter color, rarely tinged with red, and in its irregular branching, fewer and narrow paraphyllia and leaves entire or slightly serrulate above, narrower, not decurrent, often more filiform-acuminate, not rugose or plicate; with margins plane throughout, *area of quadrate alar cells much larger (6–10 in marginal row) and inflated angular cells much fewer (2–3 in marginal row) in number;* median cells usually shorter and broader and basal slightly or not at all colored; perichaetial leaves not plicate. Capsules usually more curved, often shorter; operculum often rostrate; spores at about the same time but sparingly produced with us. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 594 & 595;* M. H. M. 353, *f. 186.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 320 & 320b var.; Aust. Musc. Appal. 419, 423; Grout, N. Am. Musc. Pl. 161, 346, 393, 385 and 415.

On soil, bases of trees and rocks in moist shaded places, cosmopolitan. Widely distributed in N. America, ranging from the arctic regions to the Gulf of Mexico; from sea level to subalpine heights; rather rare and local in New England and neighboring territory, infrequent west of the Rockies.

From *H. imponens* it may usually be distinguished by its irregular branching, numerous and more dense quadrate alar cells and lack of pronounced red in the stems.

According to descriptions of Dixon and other European bryologists and the plates of the Bry. Eur. the var. *ericetorum* Bry. Eur., differs from *imponens* in little but the pale green color, but most herbarium specimens seem to be less regularly pinnate and more loosely foliate, having the capsule more curved with a plainly beaked operculum in characteristic specimens. R. & C. Musc. Am. Sept. Exsic. 138.

There are several very markedly slender forms, which have been dignified as varieties or even species, that to my mind are probably largely due to habitat conditions.

Var. RESUPINATUM (Wils.) Schimp.

Heterophyllon pseudo-nemorsum Kindb. Eur. & N. Am. Bryineae 123. 1896. Type seen.

Slender with branches often almost filiform, leaves straight or slightly curved, homomallous or erect, narrow, entire or denticulate; capsule erect and nearly or quite symmetric; operculum rostrate.

According to Dixon var. *resupinatum* when typical has the appearance of a *Pylaisia* due to the homomallous leaves. Aust. Musc. Appal. 422.

Var. FILIFORME Brid. Musc. Rec. **22**: 138. 1801. Plants extremely slender with long straight filiform branches; leaves small, branch leaves rather erect-spreading or somewhat secund; capsules rare, small. Usually on trunks of trees, occasionally on more or less perpendicular rocks. N. Am. Musc. Pl. 31.

Dixon describes var. *filiforme* as having the leaves "very regularly and neatly imbricate in two rows, falcato-secund or hamate" but Bridel, the author of the variety says "*foliis in ramulis patentiusculis rectis.*" (Bryol. Univ. **2**: 609. 1827) and most European authors agree, though allowing that the leaves may be somewhat secund.

Bridel states in a note on the same page that the filiform branches are appressed to the bark of the tree and the subcapillary leaves, scarcely reflexed, are due to the rain water which seems to run down the bark of the tree. A similar effect is produced by dripping water in *Homalothecium Nuttallii* var. *hamatidens*.

Var. SUBJULACEUM Mol. Moost. Alg. Alp. 107. 1865. Includes the robust forms of Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 473; Sull. Musc. Allegh. 70 as *Leskea flaccida*, with nearly erect leaves, is near this variety; branchlets sharp-pointed (Moenkemeyer). Apparently plants of dry rocks and soil. Arizona.

Bridel in 1812 enumerated no less than 19 varieties of this puzzling species. But the larger forms with strongly falcate-secund leaves and numerous subopaque quadrate alar cells are not difficult to identify, al-

though in these forms there are great variations in size, color (from a pale brownish-green to very dark greenish-brown with rarely a tinge of red), length and slenderness of the leaf acumination, serration of the margin and length of leaf cells. Also variable are the length and curvature of the capsule and length of beak or apiculus of the operculum. Yet these variations seem so poorly correlated as to make it difficult to define readily recognizable varieties, especially as most forms fruit sparingly.

The Lesq. & James Manual credit us with var. *lacunosum* Brid. (var. *elatum* Br. & Sch.), a very robust form approaching small forms of *Rhytidium rugosum* in appearance; branches very few and tumid; leaves very wide and concave with only the apices secund, entire or nearly so, shortly acuminate.

Austin's Musc. Appal. 420 is probably correctly referred to var. *resupinatum* while Grout, N. Am. Musc. Pl. 31 is intermediate between vars. *respinatum* and *filiforme*. Austin's 423 shows rather typical stems giving rise to filiform branches. His 421 is so depauperate as to be hard to place but it seems nearest a form of var. *ericetorum*. His 422 may be considered as a small slender *subjulaceum* or a robust *resupinatum*.

I have carefully examined the type of *Hypnum complexum* and the only distinction between it and *H. cupressiforme* is that the inner perichaetial leaves are strongly plicate. This character is scarcely enough to found a species upon in so variable a group of forms as *H. cupressiforme* and its varieties. The type of *H. complexum* is merely a slender northern form of *cupressiforme* in which the small quadrate alar cells in most cases reach to the leaf insertion. Mitten himself says of it, "In general appearance very similar to that form of *H. cupressiforme* known as *tectorum* but its affinity is in other respects with *H. reptile* . . . . but the present species is certainly dioicous, more robust, and with scarcely serrulate leaves." *Hypnum hamulosiforme* Kindb. is one of the variations of *H. cupressiforme*. The only specimen of *Hypnum pseudocomplexum* Kindb. Rev. Bryol. **22**: 85, in the Kindberg herbarium, 1895 is not the type. It is apparently a tufted form of *H. cupressiforme*.

*3. Hypnum vaucheri Lesq. Cat. Mousses Suisse 48. 1845. (not of Bry. Eur. or Lesq. & James Man. 414). *Hypnum subcomplexum* Kindb. Rev. Bryol. **22**: 88. 1895. Type seen.

A calcicolous subspecies of *H. cupressiforme* growing in dense thick cushions or mats, yellowish- to brownish-green; secondary stems ascending to suberect, freely divided and branching, sometimes pinnate; leaves more or less falcate-secund, concave; margins plane, entire or sinuolate above; stem leaves ovate to broadly ovate-lanceolate, rather abruptly narrowed to a comparatively short acumination; costa double, usually short, sometimes wanting, sometimes with one branch extending ⅓ the length of the leaf, all three forms occasionally occurring on the same plant; leaf cells broader and much shorter than in *cupressiforme;* median about 7 μ wide, 4–6 : 1 (6–8 : 1, Barnes Key), thick-walled and often pitted; small quadrate alar cells very numerous, 12–15 in marginal row, extending ½ way to leaf middle with no enlarged cells at the angles; branch leaves similar but smaller. Dioicous.

*"The pedicel is up to 15 mm. high, capsule short cylindric, about 2½ mm. long with the lid, slightly curved and erect or nodding. Lid acute, its height about equaling basal diameter. Annulus broad, 2 or 3 rows of cells high. Two or three smooth cilia between segments."

Type locality Switzerland, Jura Mts.

Illustrations:—Husnot, Musc. Gall. *pl. 117;* Moenkem. Laubm. Europas 884, *f. 213g; Pl. 32.*
Exsiccati:—Grout, N. Am. Musc. Pl. 264 & Supplement 21; R. & C. Musc. Am. Sept. Exsic. 342.
On calcareous rocks chiefly, rarely on soil (Nebraska). Said to be subalpine in Europe. British Columbia, Alberta, Dawson, Quebec, Newfoundland, Anticosti Island, Minnesota, Montana and Grand Canyon of Arizona, Utah; Lincoln Bay, Grant Land.
It grades into *H. cupressiforme* through its var. *subjulaceum;* where to draw the line is a matter of taste. The typical forms are well characterized and easy to recognize. In a letter to R. S. Williams Kindberg admitted that his *H. subcomplexum* is a synonym of *H. Vaucheri.*

4. Hypnum curvifolium Hedw. Sp. Musc. 285. *pl. 75.* 1801.

Plants large for the subgenus, in wide loosely interwoven mats, green to yellow-green, brown below; stems 5–10 cm. long, red-brown when old, irregularly divided; in well developed plants pinnately and complanately branched, but often irregularly branched; branches unequal; paraphyllia few or lacking; leaves very regularly and evenly falcate-secund in two rows, giving a characteristic plaited appearance to the plants; stem leaves 1.5–2 x 0.7–0.8 mm., elongated triangular-ovate, gradually long-acuminate, concave,

* R. S. Williams Bull. N. Y. Bot. Garden **2**: 376, describing specimens from Montana.

channeled above, with plane margins, entire or serrulate near apex, narrowed and rounded to a subcordate base at insertion, somewhat decurrent; the decurrent cells enlarged, thin-walled and hyaline; above these on the curve of the base a few small short-oblong cells; median cells linear-flexuose, ± 6 x 50–75 μ, near the base becoming shorter, broader, thicker-walled, pitted, and often colored; costa lacking or short and double; branch leaves smaller, more strongly falcate-secund and more serrate; perichaetial leaves sheathing, ecostate, the inner with several plicae. Dioicous, male and female plants growing intertangled; seta about 2.5 cm. long, red-brown below; capsule light-brown, darker with age, oblong-arcuate, inclined to horizontal, *plicate and somewhat contracted under the mouth when dry and empty*, including the operculum 2.5–4 mm. long; annulus large; operculum conic-apiculate; peristome perfect; spores in spring.

Type locality, Lancaster, Pennsylvania, Muhlenberg.

Illustrations:—Hedw. l. c.; Sull. Icones. Musc. *pl. 114;* M. H. M. 354, *f. 187;* Mosses with H-lens 178, *f. 78.*

Exsiccati:—Drumm. Musc. Am. 197, S. States 148; Sull. Musc. Allegh. 12; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 323, (Ed. 2) 480; Aust. Musc. Appal. 424; Grout, N. Am. Musc. Pl. 49, 49a, Musci Perfecti 231; R. & C. Musc. Am. Sept. Exsic. 424.

On decaying wood, stones and soil in cool moist elevated forests, from arctic America south to Georgia and Missouri in the east and to Colorado in the west. Common, especially in the mountains of the northeastern U. S.

Inundated forms are often dark brown except the young tips and occasional colonies occur in which the capsules are scarcely plicate.

5. Hypnum fertile Sendt. Denksch. Bot. Ges. z. Regensburg **3:** 147. 1841.

Hypnum pseudocircinale Kindb. Ottawa Nat. **14:** 83. 1900. Type seen.

Plants resembling slender *Hypnum imponens*, growing in wide thin closely interwoven mats, light or yellowish green, brownish below; stems mostly procumbent and attached by numerous radicles, rather rigid, reaching 10 cm. in length, reddish brown when old; branching regularly and complanately pinnate as a rule, with rather short and uniform branches; *paraphyllia narrower and less numerous* than in *imponens;* leaves close, strongly falcate-secund to subcircinate, *not decurrent;* stem leaves oblong-lanceolate, gradually narrowed to a long slender acumination, rounded and narrowed slightly to the insertion, subclasping, 1.5–2 x 0.4-0.5 mm.; *margins plane, entire below*, serrulate near the apex; costa usually short and double, sometimes lacking; median leaf cells linear-flexuose, 6–7 μ wide, 10–15 : 1; basal cells usually colored, thick-walled and pitted; at the extreme angles *just below where the narrowing begins is a small group of oblong slightly inflated and pellucid cells* (1–2 on the margin) bordering these a few (3–4) smaller denser subquadrate cells just below and in the rounded basal angles which are more or less colored; branch leaves smaller and narrowed, usually more strongly falcate and serrate; inner perichaetial leaves *strongly plicate*, 3 mm. or more long, lanceolate with a very long almost filiform, serrate acumination, more or less costate; costa thin but sometimes reaching nearly to the leaf-middle. *Monoicous;* seta reddish, 1.5–2.5 cm. long; *capsule orange-brown, arcuate-cylindric, more or less cernuous*, with operculum about 3 mm. long, 4–5 : 1, contracted below the mouth when dry and empty and often plicate; annulus large; operculum conic-apiculate; peristome perfect; *spores in early summer.* Type locality European.

Illustrations:—Bry. Eur. *pl. 591;* Jennings, Mosses W. Pa. *pl. 45;* M. H. M. 356, *f. 189.*

Exsiccati:—Aust. Musc. Appal. 417; Grout, N. Am. Musc. Pl. 54, 54a & 456 and Musci Perfecti 59.

On decaying wood in moist cool shaded places, chiefly in elevated regions from Newfoundland and Nova Scotia to British Columbia, southwards east of the Rockies to Tennessee and N. Carolina. Abundant in the mountain woods of southern Vermont and probably frequent elsewhere in New England.

H. fertile often grows intertangled with *H. imponens* and is often confused with it. However it is somewhat more slender and usually lighter colored, the stems are rarely, if ever, such a dark red; the leaves are narrower; the stem leaves entire except near the apex; the alar cells are of a similar pattern but on a much smaller scale. When in fruit the smaller arcuate capsules ripening in June make recognition easy.

6. Hypnum circinale Hook. Musc. Exot. *pl. 107.* 1820.

Hypnum sequoieti C. Muell. Fl. **58:** 91. 1875.

Rhynchostegium pseudo-recurvans Kindb. Note on Canadian Bryology 1893 and Eur. and N. Am. Bryineae 140. 1896, according to Mrs. Britton, Bryol. **5:** 66.

Plants in wide closely interwoven mats of medium thickness, light green above, brown below; stems ± 5 cm. long, dark red when mature; branching regularly pinnate; branches short, sometimes of uneven length; paraphyllia few or lacking, in the axils of the branches there are usually bunches of short filaments; radicles

numerous on the under side of stems; stem leaves falcate-secund, slightly decurrent, subclasping, *lanceolate-subulate from a subcordate base, narrowed and rounded to the insertion, gradually narrowed above to a long slender, more or less serrulate acumination*, ± 2 x 0.6 mm., concave with plane margins; branch leaves smaller, circinate-falcate, more strongly serrate; median leaf cells ± 6 μ wide, 8–15 : 1; basal shorter, thick-walled and colored, two or three decurrent angular cells larger and clear, above these a small group (2–4 on the margin) of small subquadrate cells which lie just below the curve of the rounded basal angles; costa lacking, occasionally showing short double traces; perichaetial leaves neither plicate nor costate. *Monoicous;* sporophyte small throughout; seta 1–2 cm. long, red brown; capsule brown to red-brown when old, oblong-ovoid, unsymmetric and nearly horizontal, not contracted below mouth, *including operculum ± 2 mm. long; urn about 2 : 1;* *operculum conic-apiculate to short-rostrate, about ½ the length of urn; annulus present; peristome perfect; spores late autumn to early winter. Type locality Western N. America, Menzies.

Illustrations:—Hooker, l. c.; *Pl. 32.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 474 is type of *sequoieti* and is surely *H. circinale;* Grout, N. Am. Musc. Pl. 74; Allen, Mosses Cascade Mts. 120; R. & C. Musc. Am. Sept. Exsic. 341 and 341b.

On bark of trees, decaying wood and stones along the Pacific coast from California to Alaska, common; east to Idaho.

Easily distinguished in fruit from all but the rare eastern *H. canariense* by the small capsules.

7. Hypnum canariense (Mitt.) Dixon. & Jam. Handb. Brit. Mosses (Ed. 1) 477. 1896.

Stereodon canariensis Mitt. Journ. Linn. Soc. **8:** 5. 1864.
Hypnum Waghornei Kindb. Cat. Can. Pl. **6:** 234. 1892.

Plants resembling *H. circinale* in size, appearance and fruit; leaves less narrowed to the insertion and with more numerous quadrate alar cells; median leaf cells shorter and broader: dioicous. Newfoundland, New Brunswick and Cape Breton Island. Differs from *H. cupressiforme* in the fewer quadrate alar cells, the more serrate leaves and the short, relatively thick capsule, about 2 mm. long with lid. *Pl. 35.*

"Nearly resembling *S. cupressiformis*, Brid., in the state called "mammillatus," but differing from all states of that variable moss in the sharp serrulation of its leaves and in the size of the cells—about half as long and nearly twice as wide. In some specimens the capsule is very short—not longer than wide." Mitten. Journ. Linn. Soc. **8:** 6. 1864.

I have been unable to see any authentic material of this species and it is very doubtful if it occurs in North America.

8. Hypnum subimponens Lesq. Trans. Am. Phil. Soc. **13:** 14. 1863.

Stereodon plumifer Mitt. Journ. Linn. Soc. **8:** 41. 1865.

Plants in wide rather thick, closely intertangled mats, yellow-green above, brown below; stems 5–10 cm. long, *green to brown, not red; cortical cells large 8–12 μ in diameter, thin walled;* branching regularly complanate-pinnate; branches short, more or less equal; paraphyllia few and small; stem leaves strongly falcate-secund, not decurrent, oblong-lanceolate more or less rounded and narrowed to the insertion, gradually narrowed to a long filiform acumination, 1.5–2 x 0.5–0.65 mm., entire or distantly denticulate near apex, concave, often slightly plicate; margins plane; costa short and double or lacking; median leaf cells narrowly linear-flexuose, about 6 x 45–70 μ; basal cells shorter, broader, with thicker walls and pitted at insertion; a *very few* (3–4, rarely more, along the margin) *subquadrate slightly different cells at extreme basal angles;* branch leaves smaller, narrower and more serrulate, subcircinate; perichaetial leaves ecostate, plicate or smooth, filiform-acuminate and sharply serrate above. Dioicous; seta light-brown, red-brown at base when old, about 2.5 cm. long; *capsule light-brown,* cylindric, *more or less curved and inclined,* with operculum about 5 mm. long; operculum conic-apiculate, occasionally rostellate; annulus large; peristome perfect; spores in April. Type from Marin Co., California.

Illustrations:—Sull. Icon. Musc. Suppl. *pl. 79; Pl. 32.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 475, (Ed. 2) 476; Grout, N. Am. Musc. Pl. 17, Perfecti 113; Allen, Mosses Cascade Mts. 121; Baker, Pacific Coast Bryophytes 413, 554, 575 & 576; R. & C. Musc. Am. Sept. Exsic. 136 and 136b.

Apparently common in cool moist woods west of the Rockies, from California to Alaska. Reported by Macoun from N. Brunswick and Newfoundland. Resembling *H. imponens* in gross appearance but distin-

* Hooker figured the operculum as short-conic but Allen's 120 has operculum ranging from conic to short-rostrate.

guished by the characters italicised. It is distinguished from *H. fertile* by the cortical cells, the fewer differentiated alar cells and less curved non-plicate capsules.

Var. CRISTULUM Kindb. Bull. Torr. Bot. Club. **17**: 280. 1890.

Appearance of *H. molluscum*, leaves circinate, some faintly striate. On rocks, southern part of Vancouver Id., Macoun (Described from Macoun's Can. Musc. 881a in my herbarium).

In the herbarium of the New York Botanical Garden are two specimens from the Mitten Herbarium labeled *Hypnum plumifer* and marked "type" by Mrs. Britton. One of these, collected by Drummond, is principally, if not wholly *Hypnum revolutum*. The other from "Columbia, Douglas" is *H. subimponens*. As I can find no trace of *Hypnum subplumiferum* (Mitt.) Card. except in Engler & Prantl (Ed. 2) Musci, 2: 455, I surmise it is a misprint for *H. plumiferum*.

9. HYPNUM CALLICHROUM Brid. Bryol. Univ. **2**: 631. 1827.

Plants in wide soft tufts, bright- to yellow-green; stems more or less regularly pinnate, resembling in appearance several of the preceding species, green or brown; *cortical cells large and hyaline;* paraphyllia few, filamentous to lanceolate; *leaves beautifully circinate-secund*, usually very entire, broadly oblong-lanceolate, concave, gradually narrowed to a long filiform acumination, 1.5–2 mm. long, slightly decurrent; median leaf cells narrowly linear-flexuose, 10–15 : 1; *alar and decurrent cells (2–4 marginal) hyaline-inflated*, reaching half way to middle of leaf base, bordered above by a few (3–4 marginal) small subquadrate cells; branch leaves often subserrulate. Dioicous; capsules rather large, including operculum reaching 2.5–3.5 mm. in length, cylindric-arcuate, orange-brown; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 596; Pl. 32.*

EXSICCATI:—Grout, N. Am. Musc. Pl. Suppl. 13.

On soil and stones in cold or mountainous regions. Very rare in North America; Greenland, Nova Scotia, British Columbia, Alaska.

The only Alaskan specimen of *H. Alaskae* Kindb. Eur. and N. Am. Bryinae 142. 1896 in the Kindberg herbarium is *H. callichroum*. It is probably the type.

10. HYPNUM SUBPLICATILE (Lindb.) Limpr. Laubm. **3**: 494. 1899.

Stereodon plicatulus (non Mitten 1865) Lindb. in Contrib. ad Flor. Crypt. Asiae-bor-or. 254. 1872.

Plants in rather thin interwoven mats, bright yellow-green; stems prostrate, 5–8 cm. long; branching beautifully and regularly complanate-pinnate when fully developed; cortical cells large, thin-walled; paraphyllia few; stem leaves scarcely decurrent, strongly falcate-secund to circinate, not plicate, triangular-ovate from a subcordate base, abruptly narrowed and rounded to the insertion and gradually narrowed to a long slender subfiliform acumination, about 1.5 x 0.6 mm.; margins plane and nearly or quite entire; costa short and double; median leaf cells linear-flexuose, about 5 μ wide, 8–12 : 1; at rounded basal angles a small group of small subquadrate alar cells; the larger clear cells that are sometimes found below these are apparently cortical stem cells torn off with the leaf; branch leaves smaller and narrower, lanceolate and often serrulate above, less cordate at base. Dioicous; seta 1–1.5 cm. long; capsule light brown, obovoid, inclined and slightly unsymmetric, with lid about 1.5 mm. long; operculum short-conic; annulus large; peristome perfect; spores spring to early summer. Type locality Sachalin Island. *Pl. 33.*

William's plants from Lake Lindeman, Yukon Terr., "on damp rocks, May 30, 1898. No. 751" fit Limpricht's description (Laubm. **3**: 494) almost exactly. The leaf base is much like that of *H. fertile* though more cordate and triangular instead of oblong-lanceolate; the cortical cells are larger and the capsule much shorter and only slightly unsymmetric. The smaller size and lack of inflated alar cells distinguish it from *H. callichroum* and the subcordate leaf base and short capsules from *H. subimponens*.

Hypnum implexum R. & C. Bot. Gaz. **22**: 5. *pl. 5.* 1896.

Specimens of this species have not been available but the description and illustration match *H. subplicatile* very closely and I am unable to differentiate the two. The illustrations of the plants of *H. implexum*, type, from Seal Island, Labrador, certainly fit the Lake Lindeman plants.

11. HYPNUM DIECKII R. & C. Bot. Centralbl. **44**: 423. Dec. 1890.

Hypnum canadense Kindb. Bull. Torr. Bot. Club. **17**: 280. Nov. 1890.?

Intermediate between *H. arcuatum* and *H. callichroum;* described by Renauld and Cardot as follows. "Tufts yellowish or rufescent; stems depressed, pinnate; branches ascending; leaves falcate-secund, strongly circinate, from a broadly ovate base abruptly acuminate, acute or subulate, acumination plicate at base; margins plane, entire, rarely slightly denticulate above; costa double, short, sometimes very faint, at other times prolonged to middle; cells linear, very narrow; alar large, strongly inflated, hyaline or flavescent;

perichaetial leaves oblong-lanceolate, long-acuminate. Dioicous; capsule horizontal or subpendulous, large, arcuate." Operculum conic-apiculate.

Type from near Hector, Rocky Mts. at the summit level of the Canadian Pacific R. R., alt. 5,300 ft.

ILLUSTRATION:—*Pl. 33.*

EXSICCATI:—Grout, N. Am. Musc. Pl. 99 as *H. callichroum*, det. later as *H. Dieckii* by Cardot; Allen, Mosses Cascade Mts. 121b, as *H. subimponens.* Differs from *H. arcuatum in the longer and more slender acumination of the circinate leaves, with rather less prominent alar cells;* the basal cells more incrassate, pitted and colored; and in the non-plicate capsules. From *H. callichroum* it differs in the ligher color, ovate to ovate-lanceolate leaves, less slenderly acuminate and more often serrate and its much larger capsules. *H. canadense* is described as more or less serrulate all around. The serration in the leaves of this group is greatly variable even on the same plant. Both *H. Dieckii* and *H. pratense* have the large cortical stem cells of the group.

On decaying wood and stones in wet places, usually near streams. Washington, Oregon, British Columbia and Alaska.

The type of *H. canadense* appears to be lacking in the Kindberg herbarium; in the 19 specimens identified by Kindberg in his collection as this species were several of *H. Dieckii*, one *H. callichroum*, one *H. arcuatum* and one *H. imponens.*

12. HYPNUM ARCUATUM Lindb. in Hartm. Handb. Skand. Fl. (Ed. 8) 516. 1861.
(*H. arrenatum* on p. 345 by a typographical error.) Should be H. [illegible]
MF III 268

Hypnum Patientiae Lindb. Oefv. K. Vet. Akad. Foerh. 371. 1862.
Hypnum Lindbergii Mitt. Seeman's Journ. Bot. 1864.
Hypnum pseudo-drepanium C. M. & Kindb. Macoun, Cat. Can. Pl. **6**: 240. 1892.
Hypnum Renauldii Kindb., Macoun, Cat. Can. Pl. **6**: 238. 1892.
Hypnum arcuatum Hedw. Sp. Musc. 245. 1801 is a *Rhacopilum* and of Sull. 1854 is an *Ectropothecium.*

Plants in wide, rather loose mats of moderate thickness, bright to yellowish green, glossy, brown below; stems prostrate to ascending with ascending to suberect divisions, reddish below; branching irregular to almost regularly pinnate with branches of unequal length; *cortical cells large and hyaline;* stem leaves 1.8–2.5 x ± 1 mm., ovate-oblong, *broadly acuminate, acute, or blunt at apex*, falcate-secund in two rows, sometimes slightly plicate or rugose when dry, *hooked at ends of stems and branches*, concave, usually flat at apex but sometimes channelled, entire or serrulate at apex, decurrent; margins plane; costa short and double or lacking, occasionally 1 branch longer and reaching ⅓ length of leaf; median leaf cells about 5 μ wide, 12–20 : 1; *apical cells shorter*, oblong; basal shorter, broader, thick-walled and pitted, often colored with age; at decurrent angles a considerable area (2–4 cells on the margin and reaching about half way to the middle of the leaf base) *of abruptly inflated thin-walled and hyaline alar cells; above these a few smaller irregular to subquadrate cells.* Dioicous; seta about 2.5 cm. long, light brown, red-brown with age; *capsule oblong-cylindric, arcuate, inclined to horizontal, plicate when dry and empty but not much contracted below the mouth, light brown*, darker with age, with lid about 2.5–3.5 mm. long; annulus large; operculum conic-apiculate; spores in June. Type locality European.

ILLUSTRATIONS:—Limpricht, Laubm. **3**: 499, *f. 424;* Jennings, Mosses W. Pa. *pl. 46;* M. H. M. 355. *f. 188.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 323b (as *H. curvifolium* var.), (Ed. 2) 481; Grout, N. Am. Musc. Pl. 118, 128, 141, 443; Musc Perfecti 180. Aust. Musc. Appal. 426 as *H. pratense* var.

As a rule the leaves are only a trifle (or not at all) narrowed and rounded just above the hyaline alar cells. This, the much more numerous inflated alar cells and the large hyaline cortical stem cells distinguish most forms readily from *H. curvifolium.* The leaf apices are usually almost flat but in some of the more slenderly acuminate forms they may be channelled. There is a great variation in the length and slenderness of the acumination. On the one hand slenderly acuminate western forms seem to grade into *H. Dieckii*, while in the south the leaves of var. *americanum*, at least in part, may be broadly rounded-obtuse and spoon shaped at apex.

Apparently European forms have the capsule less strongly plicate than the American. The species is also exceedingly variable in the matter of branching, but on the whole is so well characterized as to be readily distinguished in most cases from related species except perhaps *H. pratense*, which see.

Growing chiefly on wet swampy soil, often among grasses. Common in the north-eastern U. S. Including the varieties, this species ranges from arctic America to Florida in the East and to Colorado, Washington and British Columbia in the West.

The type of *H. Renauldii* has been examined. The capsules *are strongly plicate.*

Var. ELATUM Schimp. Syn. (Ed. 2) 758. 1876.

The extreme form of the erect robust plant with *Drepanocladus* habit; stems 5–8 cm. long; leaves usually

narrower and more slenderly acuminate, strongly falcate-secund, almost circinate, often somewhat plicate. Occasional.

Var. DEMISSUM Schimp. l. c.

In thin light- to yellow-green mats; stems creeping with the habit of *H. pratense*. Occasional.

Var. AMERICANUM R. & C. Bot. Gaz. **14**: 99. 1889.

"Differs from the typical form in the stems, slender, prostrate, more or less distinctly pinnate and the leaves smaller, with the acumen shorter and broader, blunt and usually denticulate at apex."

"Louisiana; Baton Rouge (Langlois)." N. Am. Musc. Pl. 420. as *H. pratense* var.

The common form in Florida and probably in the other Gulf States. Besides the blunt and rounded apex, the basal areolation is looser. Although abundant on the edges of swamps in Florida, I have never seen capsules.

Renauld in a post card written Jan. 23, 1902 wrote ". . . . Je doute que le dernier (i. e. *Hypnum Renauldii* Kindb. Macoun Cat. Can. Pl. **6**: 238) sait spécifiquement distinct du *H. arcuatum* Lindb., que offre dans l'Amerique du Nord des variations trés interessant."

Kindberg's type of *Hypnum arcuatiforme* Kindb. Macoun, Cat. Can. Pl. **6**: 238. 1892, has been examined. The leaves are channeled above and the capsules smooth except at base. A study of the European literature leads one to believe that the European plants of *H. arcuatum* are not regularly characterized by a plicate capsule. Dixon does not mention it, many continental authors also fail to mention this character. Limpricht says "schwach gefurcht" for the dry capsule. The smooth capsule is the only distinction between the two. The Kindberg type of *H. pseudo-drepanium* l. c. 240 is a form of *H. arcuatum demissum* with plicate leaves. Drummond's Musc. Am. S. States 150 as *H. cupressiforme corruscans* is also a form of *H. arcuatum*.

13. HYPNUM PRATENSE Koch, Brid. Bryol. Univ. **2**: 769. 182 .

Hypnum amoenum Hook. in Drumm. Musc. Am. 196 in part.
Hypnum subflaccum C. M. & Kindb. Macoun, Cat. Can. Pl. **6**: 240. 1892.
Hypnum pseudo-pratense Kindb. Macoun, Cat. Can. Pl. **6**: 239. Type seen.
Entodon Macounii C. M. & Kindb. Macoun, Cat. Can. Pl. **6**: 177.*

Closely related to *H. arcuatum*, from which it differs in its lax Plagiothecium-like habit, rarely pinnate branching; leaves often secund at branch tips but very slightly so elsewhere; base of leaves narrowed and rounded to the insertion; a few alar cells gradually enlarged but *not sharply differentiated or bordered by smaller quadrate cells;* leaves slightly concave, often nearly flat under the cover-glass. Capsules not plicate when dry and empty, rarely produced. Grades into *H. arcuatum* var. *demissum* but this has the abruptly enlarged and inflated alar cells bordered by the smaller cells. Spores in spring. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 611; Pl. 33.*

EXSICCATI:—Drumm. l. c.; Sull. Musc. Allegh. 20; Austin Musc. Appal. 425; Sull. & Lesq. Musc. Bor. Am. (Ed.1) 325.

Wet places in open swamps and meadows. Rare in Europe and apparently rare in America but widely distributed from arctic America to Pennsylvania, New Jersey, Colorado and Vancover Island. *Plagiothecium brevipungens* Kindb. l. c. 215 from Ottawa, Canada, Macoun, June 2, 1898, no. 812 in my herbarium also is *Hypnum pratense*.

14. HYPNUM HAMULOSUM Bry. Eur. fasc. 57–61. *pl. 590.* 1854.

Hypnum chlorochroum Jur. (according to Mol. Bayern Laubm. 260. 1875).
Hypnum Breidleri Limpr. Laubm. **3**: 493. 1899 (according to Moenkemeyer).

A very small alpine species growing in dense thick cushions; stems erect or ascending, irregularly branching as a rule, sometimes in thinner tufts almost regularly pinnate; *cortical stem cells large, thin-walled and subhyaline;* paraphyllia few and small, subulate to lanceolate; stem leaves ovate-lanceolate, concave more or less narrowed to insertion, rarely slightly decurrent, *less than 1 mm. long*, slenderly long-acuminate, strongly falcate-secund to subcircinate, entire or serrulate at apex; margins plane or somewhat recurved near the base; median leaf cells broadly linear-flexuose, about 6 μ wide, 7–12 : 1 : basal shorter and thicker-walled; often no differentiated alar cells, sometimes a line of two or three larger clear cells at extreme angles and rarely (more often in American plants) a very small group of small quadrate cells just inside these; costa double and short, sometimes reaching ¼ the length of leaf. Autoicous; capsules oblong-cylindric, more or less curved, inclined to horizontal, ± 2 mm. long; annulus present; operculum conic; peristome perfect; spores in late summer. Type locality European Alps.

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* Type not in Kindb. herbarium. Have examined Can. Musci. 436, quoted as type. All the *E. Macounii* in Kindberg herbarium is *Plagiothecium deplanatum*.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 35.*
EXSICCATI:—Macoun. Can. Musci 352.
Several European localities are cited in the original description as well as specimens sent Schimper by Drummond from Rocky Mountains. Hector, Rocky Mts., Macoun, Can. Musc. 352; Dawson, Yukon Terr., Williams. Macoun's 874 in my collection, from Anticosti, is *Drepanocladus uncinatus.*
Some European authors give the leaves as 1.5 mm. long, but I have not been able to find any such. Limpricht says the leaf margins are recurved at base and I find them so in many cases.
Apparently frequent in the Rocky Mts. region of the northern U. S. and Canada north to Alaska, south to Utah.

15. HYPNUM BAMBERGERI Schimp. Syn. (Ed. 1) addend. 698. 1860.

Stereodon circularis Mitt. Journ. Linn. Soc. **8**: 42. 1865.

Plants robust, *in dense tufts or cushions,* 3–8 cm. deep, dark brownish-green to golden-brown; stems more or less erect, usually with long erect simple divisions and a few short irregularly placed branches, but occasionally procumbent and nearly regularly pinnate; leaves close, strongly secund and circinate, 1.5–2 x 0.5–0.75 mm., from an oblong-ovate to oblong-lanceolate base *gradually narrowed to a long slender channelled acumination which is flexuose when dry,* concave, entire or sinuolate above, not plicate; margins plane; costa short and double or lacking, one branch often longer; *all leaf cells incrassate,* the median linear-flexuose, 6–7 μ wide, 6–10 : 1; basal shorter, pitted, and colored, hexagonal to quadrate angular cells few, *somewhat swollen but very thick-walled and strongly colored, obscure, forming a convex group.* Dioicous; capsules oblong-cylindric, curved, with lid about 2.4 mm. long, annulus large; operculum conic; peristome normal; spores very rare, ripe in summer, not yet found in America. Type locality summit of the Stockhorn, Swiss Alps' alt. 6000 ft. *Pl. 35.*

A rare calcicolous arctic-alpine moss, resembling a small form of *Cratoneuron falcatum* in gross appearance.

Beechey Island and Wellington Channell (Lyall); Lake Maligne, Jasper National Park, British Columbia; Yukon; Little Pendulum Island and Hurry Inlet, East Greenland. The specimens collected at Bernard Harbor, N. W. Territory, by the Canadian Arctic Expedition seem doubtfully this species. According to Bryhn this was collected by the Amundsen expedition at Herschell Island and "Gjøahavn." The plants collected at Grant Land by the Peary expedition and determined by Bryhn as *H. Bambergeri* are not that species, at least the specimens in the herbarium of the New York Botanical Garden are not. Mr. Dixon has seen these plants and suggests that they may be a form of *Drepanocladus badius.*

16. HYPNUM FASTIGIATUM Brid. Bryol. Univ. **2**: 620. 1827.

In rather thin closely interwoven mats; stems creeping, very slender; often stoloniferous at the ends; *cortical cells not enlarged;* paraphyllia present; branching irregularly pinnate; leaves densely imbricate, ovate-lanceolate, slenderly long-acuminate, not decurrent, *0.6–0.9 x 0.2–0.3,* strongly falcate-secund, concave; margins plane, entire or obscurely denticulate above; median leaf cells about 5 μ wide, 6–10 : 1; basal shorter and subrectangular; at basal angles a considerable number of small quadrate cells; branch leaves much smaller, often ovate. Monoicous; seta about 1.5 cm. long; capsules cylindric, curved and more or less cernuous, sometimes nearly symmetric and erect; when dry and empty *contracted under the mouth and striate at the neck,* with the conic-apiculate operculum about 2 mm. long; annulus present; peristome typical; spores in early summer. Type locality, Austrian Alps.

ILLUSTRATIONS:—Bry. Eur. *pl. 589; Pl. 34.*
EXSICCATI:—Ren. & Card. Musc. Am. Sept. Exsic. 340.
An alpine calcicolous moss very rare in N. America. The no. 240 of Ren. & Card. is doubtfully this species, as the leaves are too short and broad (broadly ovate) and much more shortly acuminate than typical forms. Schimper in the Bry. Eur. states that he has received specimens from the Rocky Mts. sent by Drummond; Banff, Alberta, (Brinkman), *Pipestone Pass, 7300 ft., B. C. (Macoun) also Yoho Valley, B. C. It is distinguished from *H. pallescens* by its extremely small size and from *H. hamulosum* by the small cortical cells.
Although Brotherus describes the leaf margins as plane, they are slightly but clearly recurved in his Bryotheca Fennica 92a.
In the mountains of Colorado, near Tolland, at an altitude of 10,000 ft., I collected a few fragments of a moss with less slenderly acuminate, less falcate leaves, more rounded at base and with fewer quadrate alar cells than in *H. fastigiatum.* It corresponds well with Bry. Eur. *pl. 590, H. Sauteri,* but is too fragmentary for a decisive determination.

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* In Kindberg herbarium as *H. subhamulosum.*

17. Hypnum reptile Mx. Fl. Am. Bor. 315. 1803.

Raphidostegium subadnatum C. M. & Kindb. Macoun, Cat. Can. Pl. **6**: 209. 1892.*

Plants small, slender, in thin closely interwoven mats, dark green, more or less regularly pinnate, but so interwoven that the branching is obscured; stems 2–5 cm. long, creeping; branches 4–6 mm. long; paraphyllia few, lanceolate, comparatively large; leaves close, somewhat narrowed to the insertion and slightly decurrent, *strongly falcate-secund;* stem leaves slenderly long-acuminate from an ovate base, 1 x 0.5 mm., concave, not plicate; margins plane or slightly revolute and serrulate to entire below, *strongly serrate above;* costa short and double or lacking, occasionally one branch longer and reaching nearly to the leaf middle; median leaf cells linear-rhomboidal to linear-flexuose, 6–7 μ wide, 6–10 : 1, basal shorter and broader and somewhat colored; *quadrate alar cells very numerous (10–20 marginal) and subopaque, much as in H. cupressiforme; angular inflated cells lacking;* branch leaves smaller, lanceolate, with fewer quadrate alar cells; *perichaetial leaves plicate. Monoicous;* seta 1–1.5 cm. long; capsules with lid 2.5–3 mm. long, subcylindric, somewhat curved and inclined, *shrinking most on the under side of the mouth, much as in Dicranella heteromalla, so that the operculum is almost at right angles to the lower portion of the capsule;* operculum conic, *short-rostrate;* annulus large; peristome perfect; *spores in midsummer.* Type locality Grandfather Mountains, N. Carolina.

Illustrations:—Bry. Eur. *pl. 587;* M. H. M. 357, *f. 190.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 322; Drumm. Musc. Am. 207 (as *H. cupressiforme* var.) Aust. Musc. Appal. 415; Grout, N. Am. Musc. Pl. 19, Musci Perfecti 3.

Common on bases of trees, stones and decaying wood in elevated regions, less frequent at lower levels. At about 2500–3000 ft. its place is taken in New England by *H. pallescens.* It ranges across the continent from Nova Scotia to Alaska, south to Arizona and N. Carolina in the mountains. The abundant and characteristic capsules, ripening in midsummer, make fruiting plants of this species easy to recognize, although the leaves vary a great deal in width and in slenderness of acumination. According to Cardot & Thériot *H. micro-reptile* Kindb. and *H. reptiliforme* Kindb. are synonyms of this species. Paris makes *micro-reptile* a synonym of the next.

*18. Hypnum pallescens (Hedw.) Bry. Eur. fasc 57–61. *pl. 586.* 1854.

Leskea pallescens Hedw. Sp. Musc. 219. *pl. 55, figs. 1–6.* 1801.
Rhynchostegium Jamesii Sull. Icon. Musc. Suppl. 92. *pl. 68.* 1874.
Hypnum depressulum C. Muell. Flora **58**: 91. 1875.

An alpine development of the preceding, growing on the bark of trees at high altitudes. It is less regularly pinnate; *leaves more slenderly acuminate,* more loosely arranged and less falcate-secund, less serrate, *with a smaller area of quadrate alar cells:* capsules about *½ the length of those of reptile,* nearly symmetric and erect, *not shrinking under the mouth when dry and empty;* spores in late summer. Type locality European.

Illustrations:—Bry. Eur. *pl. 586;* Sull. l. c.; *Pl. 33.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 478 (as *H. hamulosum* ?); Aust. Musc. Appal. 414; Grout, N. Am. Musc. Pl. 95.

Chiefly on the bark of coniferous trees and decaying wood, northern U. S. and Canada across the continent, south in the mountains to Tennessee.

H. pallescens can usually be distinguished at sight by the thinner mats of a more silky appearance, due to the slender, less closely imbricated leaves, branches often curved at the ends, and by the short symmetric capsules.

19. Hypnum revolutum (Mitt.) Lindb. Hedwigia **7**: 108. 1868.

Stereodon revolutus Mitt. Musc. Ind. Orient. 97. 1859.
Hypnum Heufleri Jur. Verh. K. K. Zool.-Bot. Ges. Wien, **1861**: 431. 1861.
Stereodon plicatilis Mitt. Journ. Linn. Soc. **8**: 40. 1865.
Hypnum Watsoni Lesq. & James Proc. Am. Acad. **14**: 138. 1879. (According to Austin, Bull. Torr. Bot. Club. **7**: 6. 1880, who had an authentic specimen for comparison.)

Plants either erect, densely tufted and irregularly branched or prostrate in thinner interwoven mats and more regularly pinnate, yellowish-or brownish-green; stems 3–5 cm. long, occasionally larger; cortical cells not enlarged; pseudo-paraphyllia in the axils of the branches and leaves; stem leaves crowded, falcate-secund, 1–2 x 0.5–0.8 mm., plicate-striate when dry, typically oblong-lanceolate and gradually tapering

* See Bryol. **5**: 66. 1902.

from near the base to an acumination of varying length and slenderness, entire or sinuate on the upper margins, *always concave with margins strongly revolute in the lower ½ at least*; *quadrate alar cells numerous* (10–15 marginal); median cells rather short for the genus, 5–6 μ wide, 3–7 : 1, rarely reaching 10 : 1, thin-walled; basal shorter, thicker-walled and somewhat pitted; costa short and double or lacking, rarely reaching ⅛ length of leaf; branch leaves smaller, often sharply serrulate above even in European plants. Dioicous; seta 15–20 mm. long; capsule cylindric 2–3 x 0.75 mm., more or less curved, strongly contracted under the mouth when dry, often striate when old and with the mouth almost as oblique as in *H. reptile;* operculum conic; annulus of two or more rows of cells; peristome perfect; spores in summer. Type locality, mountains of Thibet.

Illustrations:—Braithw. Brit. Moss Fl. *pl. 114;* Husnot, Musc. Gall. *pl. 116; Pl. 35.*

Exsiccati:—Grout, N. Am. Musc. Pl. 189, 364a & 367; R. & C. Musc. Am. Sept. Exsic. 398.

Common in the Rocky Mt. region at altitudes above 7000 ft. from Arizona, New Mexico and California to British Columbia and the Arctic; Black Hills, South Dakota; Greenland (Fl. Gr.). On bare exposed rocks, mostly non-calcareous. An exceedingly variable species whose variations seem to be due in large part to habitat conditions.

The larger regularly pinnate form with ovate-lanceolate to oblong-lanceolate leaves, gradually acuminate is known in Europe as var. *Molendoanum* (Schimp.) Lindb. The small form with less regular branching, smaller, narrower and non-plicate leaves is known as var. *pygmaeum* Mol. As identified by Cardot both forms were collected in Colorado by Dr. Jewett in the same mat and were issued together as N. Am. Musc. Pl. 364. *Hypnum filiforme* Kindb. Rev. Bryol. **22:** 88. 1896 (type seen) is a very slender form with small, broadly ovate short-acuminate leaves scarcely or not at all plicate and with margins less recurved, sometimes almost plane.

The capsules as represented in N. Am. Musc. Pl. 367 are very much like those of *H. reptile,* but they as a rule are less curved, the mouth less oblique and the operculum scarcely apiculate.

Though the leaves may vary from broadly ovate and short-acuminate to much larger and slenderly oblong-lanceolate with a long slender acumination, the recurved to strongly revolute margins, the conspicuous triangular patch of quadrate alar cells (varying considerably in size) and the relatively short leaf cells are usually enough to make recognition fairly easy.

20. Hypnum geminum (Mitt.) Lesq. & James. Manual. 365. 1884.

Stereodon geminus Mitt. Journ. Linn. Soc. **8:** 39. *pl. 7.* 1865.

The type is in the Mitten herbarium in the collections of the N. Y. Botanical Garden, but it is very fragmentary. It is a true *Stereodon* with no *Plagiothecium* affinity and Mitten's figures are most misleading. The branch leaves are lanceolate to ovate-lanceolate, acuminate, 0.6–0.7 mm. long, secund to falcate-secund, concave, often entire throughout, but in other cases *entire above and serrrate at base.* This and the usually strong double costa with one branch reaching nearly to the leaf middle, are its most striking characters. The median leaf cells are short-linear, about 6 μ wide, 6–8 : 1; at angles a small group (2–4 on the margin) of quadrate cells. According to Mitten the plants are monoicous; capsules ovoid-cylindric, suberect, gradually narrowed at the neck; peristome perfect, with two cilia. Type locality, Rocky Mts. alt. 6000–8000 ft., with *Plagiothecium pulchellum.*

It is evidently an arctic-alpine form, little collected and less known. It is easily distinct from any *Stereodon* known to the writer.

Hypnum obsoletinerve Kindb. Ottawa Nat. **23:** 140. 1909.

Plants growing in dense thick cushions, very brittle, small, about the size of *H. fastigiatum,* irregularly divided and branching; branches very short; leaves more or less secund; stem leaves lanceolate to ovate-lanceolate, reaching 1 mm. in length, gradually and slenderly acuminate, with acumination often filiform, entire or subserrulate at base, more or less concave with upper margins often incurved; costa simple, varying from almost nothing to fairly strong and reaching the middle of the leaf; median leaf cells oblong to oblong-linear, about 7 μ wide, 4–6 : 1; at basal angles a very small group of quadrate cells; branch leaves smaller, less slenderly acuminate, ovate to ovate-lanceolate, mostly ecostate; leaf cells shorter. "Dioicous," according to Kindberg.

On earth in swampy soil at Laggan, Alberta, Alt. 5,500 ft., June 28, 1904, no. 163. Type seen and studied.

This another obscure arctic-alpine plant of which more material is necessary to fully identify and relate. It reminds one of *H. geminum* except for the simple costa and filiform acumination. Kindberg placed it in *Campylium.* Mr. Dixon says of the type: "This is surely a *Campylium.* I have frequently seen it from Europe and Asia. It is, I feel fairly sure, a reduced form of *C. polygamum.*"

Subgenus PTILIUM Sull. Mosses U. S. 73. 1856.

21. Hypnum Crista-castrensis L., Hedw. Sp. Musc. 287. *pl. 76. figs. 1–4.* 1801.

Plants robust, rigid, growing in large loose mats; bright yellow-green above, brownish below; central strand small consisting of small thick-walled cells; stems simple or sparingly divided, ascending to erect, 5–20 cm. long; *branching regularly complanate-pinnate and beautifully plumose with branches of equal length except at the triangular end of the frond where they gradually and evenly diminish like the pinnae of a fern;* paraphyllia numerous; *stems and branches hooked at the tips* by the falcate-secund leaves; stem leaves crowded, oblong-ovate, gradually long-acuminate, somewhat narrowed to the insertion and slightly decurrent, *strongly plicate,* ± 2.5 x 1.1 mm., strongly secund, hooked above, rather thin; distantly and sharply serrate above; branch leaves much narrower, less deeply plicate, less serrate, *circinate, usually curved toward the branch below in the plane of the frond,* about 1.8 x 0.4 mm.; costa lacking or short and double; median leaf cells linear-flexuose, about 6 μ wide, 10–15 : 1, not papillose; basal shorter; alar broader, clear but often somewhat indistinct. Dioicous; seta 4–5 cm. long; capsule arcuate-cylindric, subhorizontal, light brown, reddish when old, with operculum about 3½ mm. long, 1 mm. thick; operculum dome-shaped, apiculate; annulus narrow, difficult to demonstrate; peristome perfect, papillose, with 2–4 cilia; spores in autumn. Type locality European.

Illustrations:—Hedw. l. c.; Bry. Eur. *pl. 599*; Jennings, Mosses W. Pa. *pl. 45*; M. H. M. *figs. 181 & 182;* Mosses with H-lens (Ed. 3) *plates 54, 55 & 56.*

Exsiccati:—Sull. Musc. Allegh. 22; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 318; Aust. Musc. Appal. 434; Grout, N. Am. Musc. Pl. 35 & 126.

On rocks, soil and decaying wood in cool forests. Common in the mountains, northern U. S. and Canada across the continent, south to North Carolina and Iowa, occasional at sea level as far south as Long Island, New York. When fully developed, one of our most beautiful and striking species. Near the summit of Mt. Washington and probably in similar situations elsewhere is a reduced form, darker colored, with very crowded branches so that the leaves of one branch touch the next below.

Subgenus CTENIDIUM Schimp. Syn. (Ed. 1) 631. 1860.

Plants mostly calcicolous, soft; stems with central strand, mostly prostrate; branching mostly regularly pinnate; leaves falcate-secund and *decurrent,* more or less plicate, *cordate-auriculate* (in our species) at base and rapidly narrowed to a long slender acumination; quadrate to rectangular alar cells numerous, not inflated, usually small but not thick-walled or colored.

22. Hypnum molluscum Hedw. Sp. Musc. 289. 1801.

Plants in dense, usually thin, *closely interwoven mats, glossy golden green to brownish below,* exceedingly variable in branching, robustness and curvature of leaves, *typically regularly pinnate and plumose,* occasionally fastigiate in crowded erect forms; stems reaching 10 cm. in length, prostrate to ascending; leaves imbricate when dry, *falcate-secund, plicate, usually somewhat undulate or contorted toward the apex; stem leaves slenderly long-acuminate from an auriculate cordate-triangular base, decurrent,* 1.5–2.5 x 0.9–1.2 mm.; *margins plane, strongly serrate to base; costa very short and double or lacking;* median leaf cells linear, about 7 μ wide, 8–12 : 1, somewhat papillose at back by projecting cell angles; cells becoming shorter and broader toward the leaf base, the *auricular irregularly quadrate-rhomboidal, not inflated or colored;* branch leaves much smaller, lanceolate, *scarcely auriculate or cordate,* usually more sharply serrate. Dioicous; seta 1–2 cm. long; capsule with operculum about 2.2 mm. long by a little less than 1 mm. thick, oblong to ovoid, unsymmetric, cernuous; operculum conic-acuminate; annulus large, peristome perfect; calyptra somewhat hairy when young; spores in summer. Type locality European.

Illustrations:—Bry. Eur. *pl. 598;* Jennings, Mosses W. Pa. *pl. 42;* M. H. M. 350.

Exsiccati:—Sull. Musc. Allegh. 21; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 319, (Ed. 2) 471; Aust. Musc. Appal. 433; Grout, N. Am. Musc. Pl. 124 & 124a.

On moist shaded rocks, soil and bases of trees, Newfoundland to the Rocky Mts., south to Georgia and Oklahoma, ranging from sea level in Long Island, New York, to 3000 ft. in the Carolina Mts.

In leaf structure this species strongly suggests *Hylocomium* but it is without the abundant multifid paraphyllia of that genus.

Exceedingly variable in size and habit, sometimes as fine and slender as *Drepanocladus plumulosus* (the var. *fastigiatum* Bosw.), again robust and dark colored (a form close to if not exactly representing var. *condensatum* Schimp.). I have seen no American forms as robust and red as the European var. *robustum* Boul., an alpine form which in color and size reminds one of *Drepanocladus revolvens.* From Ashville, N. Carolina (com. Dr. P. O. Schallert) comes a rather robust form with leaves not at all falcate and rarely

secund even at the tips of stems and branches (forma *orthophyllum* **n. f.**). In all these forms, however, the characteristic triangular cordate-auriculate, sharply serrate stem leaves, with characteristic cell structure as described, make it easy to recognize under the microscope. The European *molluscum* is even more widely variable than the American, no less than nine varieties being listed by Limpricht (Laubm. **3**: 447–451).

Var. MOLLUSCOIDES **n. comb.**

Hypnum molluscoides Kindb. Rev. Bryol. **22**: 85. 1895.

An arctic-alpine form with nearly entire stem leaves. All leaves more slenderly acuminate. Type from Bay Bull Arm, Newfoundland, Waghorne. Type seen. Also collected at several Labrador localities and from Cape Breton Island, Nova Scotia. Apparently common in Newfoundland as Waghorne collected it many times. Possibly a good species.

23. HYPNUM PROCERRIMUM Mol. Flora **49**: 458. 1866.

More robust and rigid than the last, golden- to brownish-green; fronds reaching 7 cm. or more in length by 2 cm. wide; branching regularly pinnate, branches becoming progressively shorter toward the stem end as in *Hypnum Cristra-castrensis;* stem leaves slightly decurrent, strongly falcate-secund, much as in the last but entire and not papillose at back, reaching 4 mm. in length. Sporophytes unknown.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. **3**: *pl. 112D;* Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *pl. 59J; Pl. 35.*

On damp rocks in arctic regions of N. America to 76° 30′ according to Brotherus. No American specimens seen.

Specimens from the arctic regions are frequently depauperate and less regularly pinnate at the ends of the stems. Perfect plants are as plumose as *H. Crista-castrensis* but much larger.

2. BROTHERELLA Loeske, Stud. 175. 1910.

Pseudo-raphidostegium Broth. (subgenus of *Stereodon*) Engler & Prantl, Musci (Ed. 1) 1073. 1908.

Plants slender and creeping; leaves secund, usually falcate-secund, ovate-lanceolate to lanceolate, slenderly acuminate, serrate, especially above, often with margins recurved below; leaf cells long-rhomboidal to linear, several alar cells inflated and hyaline, or colored when old; costa faint, double or lacking. Capsules oblong to ovoid, erect and symmetric to curved and cernuous; annulus lacking; operculum long-rostrate; exothecial cells not collenchymatous; peristome with cilia (except *tenuirostris*).

Differs from Hypnum in the long-rostrate operculum and from Sematophyllum in the non-collenchymatous exothecial cell walls and the strongly serrate leaves.

KEY.

1. Inflated alar cells relatively numerous, often reaching nearly to middle of leaf base; plants occurring west of Rocky Mts. ..... *4. Roellii.*
   Inflated alar cells less numerous; plants occurring east of Rocky Mts. ..... 2.
2. Plants very slender and little complanate; capsules erect and symmetric; peristome with cilia rudimentary or wanting ..... *3. tenuirostris.*
   Plants distinctly complanate-foliate, with strongly falcate leaves; capsules more or less unsymmetric and inclined; peristome perfect ..... 3.
3. Plants of plains and low elevations, light to yellowish-green, shining; operculum ½ the length of urn ..... *1. recurvans.*
   Plants *usually* darker and less shining, growing in cool elevated woods; operculum nearly or quite as long as urn ..... *2. delicatula.*

Mrs. Britton states, Bryol. **5**: 66, that *Rhaphidostegium subdemissum* Kindb. was described from sterile Alaskan specimens that do no belong to *Sematophyllum* in which she included this genus in part.

BROTHERELLA RECURVANS (Mx.) Fleisch. in Nova Guinea **12**: 120. 1914.

Leskea recurvans Mx. Fl. Bor. Am. **2**: 311. 1803.
Leskea squarrosa Mx. l. c.
Leskea arcuata Brid. Sp. Musc. Suppl. **2**: 64. 1812.
Hypnum recurvans Schwaegr. Suppl. **1**^{2}: 289. 1816.
Raphidostegium recurvans (Schwaegr.) Bry. Eur., Sull. & Lesq. Musc. Bor. Am. 301. 1856.

Plants in wide closely interwoven mats, *yellowish-green, very glossy;* branching irregularly pinnate; *leaves strongly falcate-secund* and turned downwards, except in slender or depauperate forms; stem leaves ovate-lanceolate, slenderly long-acuminate, not decurrent, somewhat concave, about 1.2–1.5 mm. long; margins somewhat reflexed below, sharply serrate above; costa lacking or short and double; median leaf cells linear-flexuose, ± 90 μ long, basal broader and shorter, usually somewhat colored; at the extreme basal angles are 4–8 very much enlarged and inflated cells ("bubble cells"), which may be hyaline or colored, 3–4 above these on the margins are smaller and subquadrate; perichaetial leaves strongly spinose-dentate above, not plicate. Dioicous; seta 1–2 cm. long; *capsules oblong-ovoid, curved and oblique*, the urn being 1.5–2 mm. *long, the operculum, which is long-rostrate, is about ½ the length of the urn;* spores in late autumn. Type locality, Mts. of N. Carolina.

Exsiccati:—Sull. Musc. Allegh. 18; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 301, 301b, (Ed. 2) 446; Aust. Musc. Appal. 340 & 341 (a depauperate form simulating *B. delicatula*); Drumm. Musc. 196 (in part only); Grout, N. Am. Musc. Pl. 1, Musci Perfecti 150.

Illustrations:—Sull. Icones Musc. *pl. 111;* Bryol. **6:** *pl. 1: Pl. 35.*

Mrs. Britton (Bryol. **6:** 2) says an annulus is present and figures it in *pl. 1, f. 16*, but I have never been able to demonstrate it.

Common on decayed wood and soil at base of trees in moist shaded places, more abundant in somewhat elevated regions, varying a great deal in robustness and general habit and at higher elevations (2500 ft. and above) passing gradually into the next by all degrees of intergradation. It ranges from Newfoundland to Manitoba, Minnesota, Wisconsin, south in the Alleghanies to Georgia; replaced in the Rocky Mts. and the West Coast by *B. Roellii.*

2. Brotherella delicatula (James) Fleisch.

Rhynchostegium delicatulum James, Sull. Icones Musc. Suppl. 93. *pl. 69.* 1874.
Hypnum laxepatulum Lesq. & James, Man. 358. 1884.
Rhaphidostegium Whitei Kindb. Bryin. Eur. & Am. **1:** 63. 1897.
Sematophyllum delicatulum (James) E. G. B. Bryol. **5:** 66. 1902. (Which see for complete synonymy.)

A high-altitude subspecies of the preceding, a smaller, darker-colored plant, growing in thin appressed mats, scarcely glossy, with the leaves less constantly falcate-secund. Seta and capsules shorter, the latter more nearly symmetric and more erect; the slenderly rostrate *operculum as long* as the urn, together being about 2.5–3 mm. long.; *cilia present in the type.*

Illustrations:—Sull. l. c.; M. H. M. *pl. 81.*

Exsiccati:—Sull. Musc. Allegh. 17 (as *Hypnum recurvans* var.); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 447 (as *H. recurvans*, var.); Grout, N. Am. Musc. Pl. 112 & 308.

On rotten wood, soil or at base of trees at altitudes of 2,500 ft. or over in New England, and corresponding altitudes elsewhere. Hudson Bay to Manitoba and from New England to Alabama in the East, probably in eastern Canada.

3. Brotherella tenuirostris (Schimp.) Broth. Engler & Prantl, Musci (Ed. 2) **2:** 425. 1925.

Leskea tenuirostris (Br. & Sch.) Sull. Mosses U. S. 668. 1848.
Hypnum cylindricarpum C. Muell. Syn. **2:** 308. 1850.

Plants in thin intertangled mats, dark to yellowish green; stems slender, creeping, 3–4 cm. long, their cuticular cells rather large, reaching 15 μ in width; branching pinnate, sometimes regularly so, but usually obscured by its closely interwoven habit; branches slender, short, 5–10 mm. long; leaves slightly secund, with apices turned ventrally as in the other species but scarcely complanate or two-ranked, erect-spreading when moist, loosely appressed-imbricate when dry; stem and branch leaves little different, but branch leaves smaller and sometimes more shortly acuminate, all oblong-lanceolate, gradually and slenderly acuminate, reaching 1.2 mm. in length, usually shorter, about 4 : 1; margin usually reflexed below, with few exceptions sharply serrate above; costa lacking, rarely showing short double traces; median leaf cells broadly linear, 8 μ wide, 7–10 : 1; basal cells somewhat shorter, a small group of angular cells moderately inflated, hyaline or slightly colored, above these on the margins a few smaller subquadrate cells; perichaetial leaves erect, loosely imbricate, the inner gradually narrowed to a slender, coarsely serrate acumination. Dioicous; seta about 1 cm. long; capsule erect and symmetric, with operculum 2 mm. long; operculum rostrate, ½ the length of urn; annulus lacking; cilia of peristome rudimentary or lacking; spores in early spring. Type Sull. Musc. Allegh. 60.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 109; Pl. 35.*
EXSICCATI:—Sull. Musc. Allegh. 60 (as *Leskea polyantha*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 300 (Ed. 2) 445 in part; Aust. Musc. Appal. 342 & 343.
Decayed wood, bases of trees and moist rocks. Long Island, New York; New Jersey, Pennsylvania, Ohio, Indiana; south to N. Carolina and Georgia.
I doubt the identity of the Newfoundland, Labrador and New Brunswick specimens, as all the Macoun collections at Ottawa are something else.

4. BROTHERELLA ROELLII (R. & C.) Fleisch.*

Raphidostegium Roellii R. & C. Bot. Centralbl. **44:** 423. 1890.
Sematophyllum Roellii (R. & C.) E. G. B. Bryol. **5:** 66. 1902.
Hypnum Roellii Macoun, Can. Musci 444.

Plants slender, densely cespitose, shining yellow-green, with cuticular cells reaching 15 μ in width; stems reaching 2–3 cm. in length, subpinnately branching; branches unequal, sometimes flagelliferous at end; leaves *slightly to strongly secund, sometimes almost erect, again falcate*, oblong-lanceolate, decurrent, slenderly acuminate, reaching 1 mm. in length; margins plane or recurved below, serrulate above; costa short and double, faint or nearly lacking; median leaf cells linear-flexuose, about 7 μ wide, 8–10 : 1; *inflated alar cells relatively large, the outer reaching 18 x 60 μ*, mostly in a row reaching nearly to the middle of the leaf base; inner perichaetial leaves much like large stem leaves. Monoicous; capsule oblong, subsymmetric, somewhat inclined; urn about 1.7 x 0.5 mm.; *operculum long rostrate (⅔ to once the length of the urn)* straight or bent at base; calyptra twice the length of operculum, only slightly split at base on one side much as in *B. delicatula;* peristome perfect; annulus lacking; spores in winter. Type from Enumclaw, Washington, Roell, 1888.

EXSICCATI:—Macoun. Can. Musci 444; Allen, Mosses Cascade Mts. 143; Grout, N. Am. Musc. Pl. 378.
On rotten logs in woods, British Columbia, Washington; probably with a wider range west of the Rocky Mts.

3. HETEROPHYLLUM (Schimp.) Kindb. Check List Eur. & Am. Mosses 72. 1894.
(From Can. Rec. Sci. Jan. 1894.)

Heterophyllium, subgenus of *Hypnum* Schimp. Syn. 629. 1860.

Plants robust; stems mostly prostrate; paraphyllia multiform; leaves erect-open to somewhat secund, scarcely falcate, ± concave, more or less long-acuminate; leaf cells narrowly linear, broader and yellowish at base; angular cells quadrate to rectangular and somewhat inflated; costa short and double or lacking. Monoicous; capsules often nearly erect and symmetric, annulus present; peristome perfect. Growing mainly on decaying wood.

Though following Brotherus in maintaining *Heterophyllum* as a genus, the author's private opinion is that it would better remain as a subgenus of *Hypnum*, though the gross appearance of our common *H. Haldanianum* is quite different from the general run of forms with falcate-secund or circinate leaves. Type species, *H. nemorosum.*

KEY.

Leaves entire, none secund ..... 1. *Haldanianum.*
Leaves serrate; branch leaves sometimes secund ..... 2. *nemorosum.*

1. HETEROPHYLLUM HALDANIANUM (Grev.) Kindb. l. c.

Hypnum Haldanianum Grev. Ann. Lyc. of New York **1:** 275, *pl. 23.* 1825.
†*Hypnum flaccum* C. M. & Kindb.; Macoun, Cat. Can. Pl. **6:** 240. 1892.

Plants in loose wide mats, usually dark or brownish green, with the habit of *Brachythecium oxycladon;* stems 3–8 cm. long, creeping, irregularly branching; *paraphyllia large multiform, ovate, lanceolate and palmate;* leaves on the ascending stems and branches *loosely and nearly evenly imbricate; stem leaves not decurrent,* broadly ovate-lanceolate to oblong-ovate, 1.5–2 x 0.6–0.9 mm., rather rapidly narrowed to a short acumination, very concave; margins plane and entire; median cells about 6 μ wide, 12–18 : 1; basal shorter and broader;

* Citation from Engler & Prantl l. c. 424.

area of enlarged and inflated alar cells large (3–5 on the margin) *forming distinct auricles bordered above by a line of smaller subopaque quadrate cells.* Seta 1–2 cm. long, red; *capsules long-cylindric,* with lid 3–3.5 mm. long, *suberect or inclined, somewhat curved; operculum short-rostrate;* spores in late autumn or winter. Type locality near Moose Factory, Canada, J. Haldane.

ILLUSTRATIONS:—Bry. Eur. *pl. 92;* Jennings, Mosses W. Pa. *pl. 46;* M. H. M. 358. *f. 191.*
EXSICCATI:—Drumm. Musc. Am. 180, S. States 114; Sull. Musc. Allegh. 14; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 324, (Ed. 2) 482; Aust. Musc. Appal. 430, 431 & 432; Grout N. Am. Musc. Pl. 47 & 47a and Musci Perfecti 37; Macoun, Can. Musci 355.
Common on soil, humus and especially rotting wood in moist shaded places; "Nova Scotia to Montana and south to the Gulf States" (Jennings).

2. HETEROPHYLLUM NEMOROSUM (Koch) Kindb. l. c.

Hypnum nemorosum Koch in Brid. Bryol. Univ. **2**: 422. 1827.
Hypnum subrectifolium Sull. Musc. Allegh. 15. 1846.

Plants somewhat more robust than *H. Haldanianum,* growing in wide loose mats, bright to pale green; stems 5–10 cm. long, more or less regularly pinnate with branches of unequal length; central strand lacking; paraphyllia in the branch axils, multiform; leaves erect-spreading when moist, more appressed when dry; stem leaves ovate to oblong-ovate, somewhat concave, narrowed above to a long lanceolate-subulate acumination (which is spinose-serrate and often flexuose) 2–2.5 mm. x 0.7–1 mm., slightly or not at all decurrent; margin plane or slightly reflexed below; costa short and double or lacking; median leaf cells linear, about 6 μ wide, 5–7 : 1; basal shorter and broader, incrassate, pitted and colored; at basal angles a group (3–5 on the margin) of quadrate to short-rectangular inflated, hyaline or colored cells, which are thick-walled; branch leaves often slightly secund toward the branch tips, smaller and narrower than the stem leaves, at the branch middle 1.2–1.5 mm. long. Seta ± 2 cm. long, dark red to purplish; capsule, oblong-cylindric, curved, nearly erect to cernuous, red-brown, with operculum 3–3.5 mm. long, little contracted under the mouth when dry and empty; operculum conic-apiculate; spores in autumn. Type locality European (Rheinpfalz).

ILLUSTRATIONS:—Bry. Eur. *pl. 593; Pl. 34.*
EXSICCATI:—Sull. Musc. Allegh. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 325; (Ed. 2) 483 Grout, N. Am. Musc. Pl. 310, Musci Perfecti 192.
On decaying wood in mountain woods in the southern Appalachian Mts., south to Georgia, north to Virginia.

4. SEMATOPHYLLUM Mitt. Jour. Linn. Soc. 8: 5. 1865.

Rhynchostegium, subgenus *Raphidostegium* Bry. Eur. fasc. 49–51. 1852.

Plants mostly slender; branching irregular to subpinnate, branches spreading to erect, often curved, somewhat julaceous; leaves symmetric and equally spreading to somewhat narrowed to the insertion, not decurrent, ovate to oblong-ovate or oblong-elliptic, concave, not plicate, *with margins entire or nearly so* and strongly reflexed in most cases; costa lacking or short and double; leaf cells linear-flexuose to fusiform; basal oblong to rectangular, often colored; apical rhombic to oblong; *at basal angles 3–8 large inflated, pellucid, hyaline or colored cells, very conspicuous.* Monoicous in all our species; capsules small, oblong-ovoid, erect and symmetric to more or less unsymmetric and inclined; operculum rostrate; peristome usually perfect; cell walls of the exothecium *plainly collenchymatous* in all our species. The leaves described in specific descriptions are from the middle of well developed branches.

KEY.

1.	Plants growing on bark of trees or decaying wood; capsules erect and symmetric or nearly so	2.
	Plants growing on rocks; capsules more or less inclined and unsymmetric	3.
2.	Median leaf cells linear-fusiform, 8–12 : 1	*1. adnatum.*
	Median leaf cells fusiform-rhomboidal, 3–7 : 1	*3. caespitosum.*
3.	Perichaetial leaves serrulate	*2. Smallii.*
	Perichaetial leaves entire	4.
4.	Plants robust; leaves 2–2.5 mm. long	*5. marylandicum.*
	Plants more slender; leaves 1.5 mm. long, or less	*4. carolinianum.*

1. SEMATOPHYLLUM ADNATUM (Mx.) E. G. B. Bryol. **5**: 65. 1902.

Leskea adnata Mx. Flor. Bor. Am. **2**: 311. 1803.
Hypnum microcarpum C. Muell. Syn. Musc. **2**: 326. 1851; Sull. Icon. Musc. 175. *pl. 110.* 1864.

Plants in rather small thin mats or patches, green to golden-green; stems prostrate, sending up numerous suberect curved branches; leaves rather closely imbricate when dry, *narrowly oblong-lanceolate, gradually acuminate,* ± 1 mm. long; margins broadly reflexed, entire or nearly so, somewhat secund, especially at the branch tips; costa lacking or nearly so; median leaf-cells linear-fusiform, averaging about 6 μ wide somewhat flexuose, about 8–12 : 1; basal shorter, often colored; at basal angles a row of 3–4 inflated cells along the insertion, above these a small group (3–4 along the margin) of smaller quadrate to rectangular cells; perichaetial leaves entire or somewhat sinuate at apex. Seta 5–10 mm. long, capsule chestnut colored, about 1–1.3 mm. long, oblong to oblong-ovoid, erect and symmetric or nearly so; constricted below the mouth when dry and empty; annulus lacking; operculum rostrate, nearly as long as the urn; peristome perfect with cilia short and single; spores in autumn. (See remarks M. H. M. p. 361.)

ILLUSTRATIONS:—Sull. l. c.; M. H. M. *pl. 82.*
EXSICCATI:—Drumm. Musc. Am. 107 (as *Hypnum crassiusculum*); Sull. Musc. Allegh. 65 & 66 (as *Leskea*);—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 299, (Ed. 2) 443. Grout, N. Am. Musc. Pl. 255 & Musci Perfecti 68.
On bark of trees, usually on living trees, Pennsylvania, New Jersey and Rhode Island, and south to the Gulf, west to Texas. Common in the Southern States.

2. SEMATOPHYLLUM SMALLII Williams, Bryol. **23**: 76. 1920. *pl. 6.*

Plants in thin mats; stems mostly 5–6 mm. long, bearing few branches and radicles; stem leaves nearly straight, widely spreading, more or less complanate or slightly secund, mostly 0.8–1 mm. long, ovate-lanceolate, acute to short-acuminate, entire and ecostate; leaf cells elongate-rhomboidal to more or less linear, *the median mostly 5–6 μ wide by 25–40 μ long,* the alar yellowish, enlarged and inflated; perichaetial leaves variable in length, the longer a little exceeding those of the stem, *more or less serrulate with spreading, sometimes recurved teeth below the acumination* and usually abruptly narrowed to an acute, slightly serrulate acumination about ⅓ the entire length of the leaf. Autoicous, a male flower often at or near the base of the perichaetium; seta 6–8 mm. long; capsule urn about 0.6 mm. long, inclined or nodding, somewhat obovate, contracted under the mouth when dry and empty; median exothecial cells nearly square to short rectangular, with walls slightly thickened at the angles; annulus lacking; operculum long-rostrate, nearly as long as the urn; peristome perfect with cilia single, inner peristome from a basal membrane about ½ the height of the teeth, *which are narrowly furrowed along the median line;* spores late spring to early summer. Type locality, Goodburn Hammock, Dade Co., Florida.
Type in herb. New York Botanical Garden, collected by J. K. Small and C. A. Mosier, June 1915, no. 6242. Also collected in Royal Palm Hammock by Dr. Small, Jan. 1, 1916, no. 7153.

This species is scarcely as large as *S. adnatum* from which it is distinguished by its serrulate perichaetial leaves and furrowed peristome teeth, also its less slenderly pointed leaves and shorter leaf cells. (The above description is compiled with little change from the original description.)
ILLUSTRATIONS:—Bryol. l. c. *pl. 6; Pl. 36.*

3. SEMATOPHYLLUM CAESPITOSUM (Sw., Hedw.) Mitt. Jour. Linn. Soc. **12**: 479. 1869.

Hypnum caespitosum Sw. Prod. Fl. Ind. Occ. **3**: 1807. 1795.
Leskea caespitosa Hedw. Sp. Musc. 233. 1801. *pl. 49, f. 1–5.*
Hypnum Kegelianum var. *tenue* C. Muell. Syn. **2**: 325. 1851.
Sematophyllum subpinnatum (Brid.) E. G. B. Bryol. **22**: 53. 1919.
Leskia subpinnata Brid. Bryol. Univ. **2**: 287. 1827.
Raphidostegium Kegelianum (C. Muell.) Jaeger & Sauerb. var. *floridanum* R. & C. Bot. Gaz. **15**: 61. 1890.

Plants in rather loose patches, dark to yellowish green; stems prostrate, 2–4 cm. long, irregularly branching, with numerous short erect or curved branches; leaves close, more or less secund, ovate to oblong-ovate, acute to broadly short-acuminate, reaching 1 mm. in length, usually shorter, entire, concave, with margins slightly recurved, ecostate or nearly so, rather gradually narrowed to the non-decurrent insertion; median leaf cells fusiform-rhomboidal, about 7 μ wide, 3–7 : 1; apical shorter, rhomboid-elliptical; basal also shorter, rectangular and colored, a single row of 3–4 cells along the insertion at the basal angles some-

what larger and slightly inflated, above these a narrowly triangular patch of quadrate alar cells (6 or more along the margin); inner perichaetial leaves broadly ovate, short-acuminate, entire. Seta short, about 5 mm. long; capsules oblong-ovoid, erect and symmetric or nearly so; urn 1.2–1.5 mm. long; operculum rostrate, fully ½ the length of the urn; annulus lacking; peristome perfect except for the lack of cilia; spores in winter. Type locality, West Indies.

ILLUSTRATION:—*Pl. 36.*

EXSICCATI:—Grout, N. Am. Musc. Pl. 273.

On bark of trees and decaying logs, Florida, rare.

Rather larger and coarser than *S. adnatum*, with broader leaves and shorter leaf cells; beak of operculum shorter.

The synonymy of this species is much involved and a thorough study of the types is needed to clear it up. Hedwig's figures of *Leskea caespitosa* do not match the Florida plant as Mrs. Britton and I know it, as the figures of the leaves are too slender at apex.

Brotherus, in the second edition of Engler and Prantl, says that the species is "*formenreich*" and apparently includes the plants from Louisiana collected by Langlois, which have been identified by Cardot as *S. Kegelianum*. These are rather more slender and a dirty green as if inundated at times.

4. SEMATOPHYLLUM CAROLINIANUM (C. Muell.) E. G. B. l. c. 66.

Hypnum carolinianum C. Muell. Syn. Musc. **2**: 327. 1851.
Raphidostegium carolinianum (C. Muell.) Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876–77**: 401. 1877.
Hypnum demissum Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298, (Ed. 2) 441.

Plants larger than the last, darker green, dirty green below, growing on wet rocks; stems 2–3 cm. long prostrate, irregularly branched; branches less erect often not curved; *leaves ovate to oblong-ovate*, contracted to the insertion, strongly concave with reflexed margins, acute or very short-acuminate, scarcely secund, 1–1.3 mm. long; alar cells much as in *adnatum;* median cells shorter, about 7 μ wide, 6–8 : 1, linear-fusiform; apical shorter, 2–3 : 1; basal shorter, subrectangular and colored, a small group (2–3 along the margin and base) enlarged and inflated, bordering these a few smaller subquadrate cells; perichaetial leaves more slenderly acuminate, entire, the inner larger than the other leaves. *Capsules inclined, more or less curved and unsymmetric,* strongly contracted under the mouth when dry and empty, about the same size as in *adnata* or a trifle larger; operculum a little shorter than the urn; peristome perfect, with cilia 1 or 2; spores in summer.

Type locality, Grandfather Mt., N. Carolina, Sull. Musc. Allegh. 48.

ILLUSTRATIONS:—Jennings, Mosses W. Pennsylvania *pl. 48; Pl. 36.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298 (as *Hypnum demissum*) and 298b, a robust form approaching *S. marylandicum*, (Ed. 2) 440 & 441; Grout, N. Am. Musc. Pl. 302 & 307. Aust. Musc. Appal. 338 (as *H. demissum*).

Eastern North America from southern Canada to Georgia. Apparently common in the South Atlantic states.

Var. ADMIXTUM (Sull.) Grout, M. H. M. 363. 1910. Growing on stones but in drier situations than the typical form; plants lighter green; branches shorter, more erect and more curved at the ends when dry; leaves more closely imbricated when dry, smaller and usually narrower.

In dry situations this variety resembles *S. adnata* in appearance except for the curved cernuous capsules.

EXSICCATI:—Aust. Musc. Appal. 339; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 299 b, (Ed. 2) 444.

Massachusetts to Florida, apparently more common near the coast; Indiana, Welch.

Sterile it is difficult to distinguish from *adnatum*, but its capsules when soaked out are always inclined and unsymmetric and the cilia are better developed.

Musc. Bor. Am. (Ed. 1) 298 b is a form of *carolinianum* found in the northern part of its range that varies in the direction of *marylandicum* in size and cell structure.

5. SEMATOPHYLLUM MARYLANDICUM (C. Muell.) E. G. B. Bryol. l. c.

Hypnum marylandicum C. Muell. Syn. Musc. **2**: 328. 1851.
Raphidostegium marylandicum Jaeger & Sauerb. l. c. 388.
Hypnum demissum var. *marylandicum* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298c. 1856.

Plants dark green, in wide loosely interwoven mats, much larger than any of our other species; stems 5–10 cm. long, resembling *Brachythecium plumosum* in gross appearance and *Hygrohypnum ochraceum* in leaf characters; leaves occasionally somewhat secund, especially at stem and branch tips, oblong-ovate, acute or with a very broad and short acumination, 1.5–2 mm. long, 0.6 to nearly 1 mm. wide, very concave, with margin entire and often not at all reflexed; median leaf cells linear-flexuose, about 7 μ wide, 8–12 : 1;

basal shorter, incrassate and colored; inflated alar cells 2–6, often thick-walled, bordered above by small cells; *apical shorter 2–3 : 1*, oblong to rhomboidal. Sporophytes very small for the size of the plants, little different from the last; spores apparently in spring.

Type locality "Backbone Mt., Maryland, Sull. Musci Allegh. 49" (as *Hypnum demissum* var.).

The leaf outline and alar cells of *S. carolinianum* are very little different from those of *marylandicum* but are on a much smaller scale.

Exsiccati:—Sull. & Lesq. l. c. and (Ed. 2) 442; Aust. Musc. Appal. Suppl. 541; Grout, N. Am. Musc. Pl. 201 & 324.

On stones and ledges in and near cold brooks, mainly in the mountains; White Mts. of New Hampshire to Georgia; frequent in the mountains of the southern part of its range.

S. marylandicum and *S. carolinianum* appear to grade into each other; the size and length of leaf cells are the surest distinctive characters.

Easily confused with *Hygrohypnum eugyrium* when sterile; *eugyrium* has traces of a double costa and serrations in many of its leaves and the alar cells are thinner-walled at the extreme angles.

5. HOMOMALLIUM (Schimp.) Loeske, Hedwigia **46**: 314. 1907.

Hypnum subgenus *Homomalium* Schimp. Syn. (Ed. 1) 616. 1860.

Stems usually creeping and attached firmly to the substratum by rhizoids; branches short, erect or arched, equally spreading or occasionally somewhat secund at stem and branch tips; leaf margins plane and entire or slightly denticulate near apex; costa short and double or lacking; leaf cells prosenchymatous, often linear, not papillose in our species; smaller quadrate alar cells numerous. Capsules cernuous to horizontal; ovoid to oblong, cylindric, unsymmetric, strongly curved and contracted under the mouth when dry and empty; peristome perfect with 2–3 well-developed cilia; annulus present. Type species *H. incurvatum*.

Distinguished from *Heterophyllum* by the more slender habit and shorter more curved capsules and shorter leaf-cells. From *Hypnum* by the less secund leaves. Closely related to *Pylaisia* but differing in the cernuous unsymmetric capsules with a perfect peristome, also in the leaves rarely secund in most species.

Key.

1.	Leaves, at least the terminal, somewhat secund	2.
	Leaves equally spreading, not at all secund	1. *adnatum*.
2.	Arctic-alpine, doubtfully North American	*incurvatum*
	Subtropical, found only in Arizona & New Mexico	2. *mexicanum*.

1. Homomallium adnatum (Hedw.) Broth. Engler & Prantl, Musci (Ed. 1) **2**: 1027. 1908.

Hypnum adnatum Hedw. Sp. Musc. 248. *pl. 64, f. 5–10.* 1801.
Amblystegium adnatum (Hedw.) Aust. Musc. Appal. 370. 1870.
Amblystegiella adnata (Hedw.) Nichols, Bryol. **11**: 5. 1908.

Plants in thin closely adherent patches, dark green, sometimes light green to yellowish-green; stems slender, prostrate, freely but rather irregularly branching; branches short, about 2.5 mm. long, erect; leaves crowded, erect-spreading when moist, loosely appressed when dry, ovate to oblong-ovate, abruptly and broadly short-acuminate, concave, very entire (with rare exceptions), ± 0.8 mm. long and less than half as broad; costa short and double, rarely single, often wanting; median leaf-cells hexagonal-linear, averaging 6.5 x 4.3 μ; *apical cells shorter, nearly rhomboidal; quadrate alar cells numerous*, sometimes extending up ⅓ length of leaf on the margin, often somewhat transversely elongated; perichaetial leaves long-acuminate, dentate or denticulate above and costate to the middle. Monoicous; seta 0.5–1.5 cm. long, purplish below; capsule oblong to oblong-cylindric, cernuous and curved, brown to reddish, ± contracted below the mouth when dry and empty, with operculum 1.5–2 mm. long; operculum conic to long-conic and apiculate; annulus broad; peristome perfect; cilia 1 or 2; spores in summer; calyptra as long as capsule, split ½ its length. Type locality, Lancaster, Pennsylvania, U. S. A.

Illustrations:—Hedw. l. c.; Sull. Icon. Musc. *pl. 121;* Cheney, Bot. Gaz. **24**: *pl. 11, f. 5;* M. H. M. figs. 202 & 203.

Exsiccati:—Drumm. Musc. Am., S. States 113; Sull. Musc. Allegh. 28; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 344, (Ed. 2) 521, 522; Aust. Musc. Appal. l. c.; Grout N. Am. Musc. Pl. 144, 144a; R. & C. Musc. Am. Sept. Exsic. 247.

Southern Canada west to the Rocky Mts., south to West Virginia and Texas. Common on stones and bases of trees in shaded places in New England and adjacent territory.

Distinguished from *Hypnum reptile* by its terete branches, equally spreading, and entire short-acuminate leaves; from *Amblystegiella subtilis* by its larger size and more numerous quadrade alar cells, curved capsules and perfect peristome; from nearly all forms of *Hypnum cupressiforme* by its small size and non-secund leaves; the leaves individually remind one of *Pylaisia* but the non-secund leaves and curved capsules with perfect peristomes make separation easy.

Plants growing on stones sometimes have the leaves as broadly ovate and short-acuminate as those figured by Cheney, with the quadrate alar cells very numerous and the cells of the upper ⅓ of the leaf rounded diamond-shaped, as figured by Sullivant. On trees the leaves are often more gradually narrowed to a longer acumination, becoming oblong-lanceolate, as figured by Sullivant. In this form the quadrate alar cells are much less numerous and the median and upper cells more elongated as figured by Cheney.

Platygyrium repens, when sterile, is often difficult to distinguish from *H. adnatum*, but the more slender acumination and longer leaf cells of *Platygyrium* will distinguish it to the practiced eye.

2. Homomallium mexicanum Cardot, Rev. Bryol. **37**: 53. 1910.

Plants in rather thin interwoven mats or patches, dark- to yellowish-green, more or less divided, somewhat regularly pinnate with branches of unequal length; branches erect to ascending; leaves crowded, erect-open even when dry, sometimes somewhat secund, especially at stem and branch tips, ovate-lanceolate, more slenderly acuminate than in the last, concave, with margins often somewhat reflexed below, entire or frequently sinuate-dentate above, ± 1 mm. long; costa double, short, or lacking; median leaf cells hexagonal-oblong to oblong-linear, rather thick walled, about 7 μ wide, 4–5 : 1; quadrate alar cells minute, about 7 μ in diameter, numerous, extending along the margin ¼–⅓ length of leaf; perichaetial leaves more or less dentate above. Monoicous; seta about 1 cm. long; capsule oblong cylindric to oblong-ovate, cernuous and more or less curved, more or less contracted under the mouth when dry and empty; annulus present; operculum conic-apiculate to rostellate; peristome perfect; spores in August.

Type locality state of Hidalgo, Mexico, Pringle, nos. 10631 & 15250, 1908.

Cardot (l. c.) says much more robust than *H. adnatum*, this species approaches *H. loriforme* (Broth.) Broth., from the Himalayas, from which it differs in the less concave leaves, the shorter and less slender acumination, the thicker walls of the leaf cells and the smaller alar cells.

Illustrations:—*Pl. 36.*

Exsiccati:—Grout, N. Am. Musc. Pl. Suppl. 4; Bartram, Mosses of Southern Arizona, 127 & 128.

On soil and base of trees alt. 6000 ft. or above. Also collected in New Mexico, White Mts., Lincoln Co., Wooton & Standley, no. 3977; Cloudcroft, Sacramento Mts., Wooton, no. 3755 (in part); Grant Co. Holzinger.

Distinguished from *H. adnatum* by its more robust appearance due to its relatively larger size and more spreading leaves with a more slender acumination, which is sinuolate-dentate in the plants from New Mexico and Arizona.

Var. latifolium Card.

Plants as a whole much more robust; leaves reaching 1.5 mm. long, more closely imbricate, broadly ovate, abruptly short-acuminate, very concave, entire; quadrate alar cells rather more numerous.

Type in Herb. Cardot at Natural History Museum, Paris and cotype in Herb. A. J. Grout, from White Mts., Lincoln Co., New Mexico, Wooton and Standley, no. 3786, 1907. N. Am. Musc. Pl. 460. *Pl. 36.*

A well-marked variety, possibly a good species. Also collected in the Santa Rita Mts., southern Arizona by Bartram.

Homomallium incurvatum (Schrad.) Loeske is reported from Newfoundland in Barnes and Heald's Key, but neither Macoun in his Catalogue of Canadian Plants nor Brotherus in Engler & Prantl mention it as American and I have been unable to find an American specimen.

6. AMBLYSTEGIELLA Loeske, Moosfl. d. Harz 294. 1903.

Plants small to minute, very slender, in very thin mats or patches, dark to light green; *stems without central strand, filiform*, irregularly branched, creeping; branches short and erect or longer and variously arranged; paraphyllia lacking; leaves rather loosely arranged, equally erect-spreading, scarcely decurrent, lanceolate to lance-subulate, *with plane entire margins* (except some leaves of *A. Sprucei*); costa entirely lacking or short and double; median leaf cells oblong-hexagonal to rhomboidal, 2–4 : 1, rarely twice this; alar quadrate (except in *A. minutissima*); capsules erect and symmetric to horizontal and curved; peristome hypnaceous with cilia rudimentary or lacking to well developed and 1 or 2; operculum convex to long-conic. Type species, *A. Sprucei.*

In its lack of central strand and costa this genus resembles the Hypneae much more than the *Amblystegiae* and the short and relatively broad leaf cells are found in many species of the Hypneae.

Nearly all our species have a tendency to become stoloniferous and the stolons have leaves much smaller than the normal. *Leskea tectorum* var. *flagellifera* Best is likely to be confused with *Amblystegiella*, especially *A. confervoides*, but the median cells on the flagella are scarcely longer than broad and usually some normal *Leskea* leaves can be found by which to determine the plants.

KEY.

1. Plants growing on the base of deciduous trees; leaves reaching 0.6 mm. or more in length ..... *1. subtilis.*
   Plants growing on stone, especially limestone; leaves usually less than 0.5 mm. in length. 2.
2. Leaves narrowly triangular-lanceolate, not narrowed to the insertion; alar cells at margin all longer than broad; median 5–8 : 1 ..... *4. minutissima.*
   Leaves narrowed to the insertion; median leaf cells shorter, alar quadrate ..... 3.
3. Quadrate alar cells conspicuous: monoicous; capsules curved and cernuous ..... *2. confervoides.*
   Quadrate alar cells very few (1–3 on the margin), or lacking in some leaves: dioicous; capsules erect or nearly so ..... *3. Sprucei.*

1. AMBLYSTEGIELLA SUBTILIS (Hedw.) Loske, l. c.

Leskea subtilis Hedw. Sp. Musc. 221. 1801.
Amblystegium subtile (Hedw.) Bry. Eur. fasc. 55–56. *pl. 561.* 1853.

Plants small and slender although *the largest we have in the genus*, in thin closely interwoven dark-green mats; stems prostrate, 1–3 cm. long, irregularly but freely branched; leaves lanceolate to linear-lanceolate, *slenderly long-acuminate*, narrowed to the insertion, not decurrent 0.25–0.6 mm. in length, entire, appressed when dry; costa short and faint or lacking; median leaf cells oblong-hexagonal, ± 8 μ wide, 2–3 : 1; *quadrate alar cells numerous* (± 10 along the margin) *and often transversely elongated.* Monoicous; seta about 1 mm. long or less, brown; *capsules oblong-cylindric, 1–1.5 mm. long, nearly or quite erect and symmetric;* annulus present; cilia of peristome *rudimentary or lacking;* operculum convex to conic; spores August to September. Type locality, Switzerland. "Type in herb. Haller, Berne, Switzerland," according to Cheney, Bot. Gaz. **24:** 252. 1897.

ILLUSTRATIONS:—Bry. Eur. l. c.; Cheney Bot. Gaz. **24:** *pl. 11, f. 3;* M. H. M. *figs. 201 & 202.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 342, (Ed. 2) 519; Aust. Musc. Appal. 369; Grout, N. Am. Musc. Pl. 12.
On bases of hardwood trees in cool moist forests. Southern Canada and northern U. S. west to Minnesota and Wisconsin, south to New Jersey, Pennsylvania, Ohio and Illinois; not rare in New England and adjacent regions.

2. AMBLYSTEGIELLA CONFERVOIDES (Brid.) Loeske, l. c.

Hypnum confervoides Brid. Spec. Musc. 2: 153. 1812.
Amblystegium confervoides Br. & Sch. Bry. Eur. fasc. 55–56. *pl. 562.* 1853.
Amblystegium pseudo-confervoides Kindb. Rev. Bryol. **22:** 84. 1895.

Plants dark green, in thin closely adhering patches on moist rocks in damp shaded places; stems 60–90 μ in diameter, freely branching, often with more slender stoloniferous branches or stem endings; leaves distant, ovate to ovate-lanceolate, erect-spreading, more appressed when dry, ± 0.1 x 0.25 mm. (Limpricht's measurements are considerably larger), acute or acuminate with acumination usually stout, entire or occasionally subdenticulate, ecostate; median leaf cells prosenchymatous, variously shaped, *oval, triangular, hexagonal, or rhomboidal,* averaging 7 x 21 μ but with wide variations above and below these measurements; *alar cells quadrate to irregular about 3 rows extending up the margin 5–10 cells.* Perichaetial leaves ovate-lanceolate, abruptly contracted into a narrow acumination which is denticulate at base. Monoicous; seta 5–8 mm. long; capsules with operculum 1.3–1.6 mm. long, ovoid to cylindric, *inclined to horizontal, symmetric to slightly curved,* not contracted below the mouth when dry, dark brown; *peristome perfect, with cilia;* annulus narrow; operculum conic-apiculate; spores late summer to autumn. Type locality Austria.
Type in herb. Bridel.

ILLUSTRATIONS:—Bry. Eur. l. c.; Cheney, l. c., *f. 1.* M. H. M., *f. 202.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 520, at least in part; Aust. Musc. Appal. 368; Grout, N. Am. Musc. Pl. 317. R. & C. Musc. Am. sept. Exsic. 326.

Cheney (Bot. Gaz. **24**: 251. 1897) says "A small plant, very generally confused with *A. Sprucei* and *A. subtile*. . . . From the former it may usually be readily distinguished by characters referred to under that species" (i. e., *A. Sprucei* has leaves serrulate throughout, elongated cells in the alar region and linear ones at the apex)" from the latter it is distinguisled by the its smaller cells in the alar region and shorter and more irregular cells in the middle and apical regions. Futher, *A. subtile* shows a distinct trace of costa in most leaves and has its parts in general ½ larger."

The author takes this opportunity of acknowledging his indebtedness to this monograph of Cheney's, which has been followed to a great extent.

New England, southeastern Canada, Ontario, along the Great Lakes, and in the Rocky Mts. Infrequent and local.

Forma *brevifolia* Grout, M. H. M. 377. 1910. Leaves shortly and broadly acuminate, leaf cells short 1–2 : 1. Macoun Canadian Musci 820 (a reissue in herb. Grout) and Dupret Mt. Royal, Montreal, Nov. 28, 1908. The latter the type in herb. Grout. (See note, M. H. M. 377.)

3. Amblystegiella Sprucei (Bruch.) Loeske, l. c.

Leskea Sprucei Bruch, Spruce, London Journ. Bot. **1845**: 180. 1845.
Amblystegium Sprucei Bry. Eur. fasc. 55–56. *pl. 561.*

Plants about the size of the last and growing in similar situations, bright green above, becoming yellowish with age; leaves about the same size and shape as in the last, but *usually serrulate and more slenderly acuminate, distant, spreading;* often with multi-cellular brood bodies in the axils;* *median cells longer, 3–6 : 1; subquadrate or rectangular alar cells few (rarely more than 3 along the margin), none transversely elongated; perichaetial leaves ciliate-dentate above!* Dioicous; seta reddish purple, 0.5 cm. long, rarely reaching 1 cm.; capsule erect and symmetric or nearly so, subglobose to oblong-obovate, 0.5–1.5 mm. long by about ½ as thick, funnelform or turbinate when dry and empty; operculum convex, mammillate to conic apiculate; annulus present; peristome without cilia; segments linear; spores in summer. Type locality Pyrenees. "Type in herb. Bruch, Berlin?" (Cheney).

Illustrations:—Bry. Eur. l. c.; Cheney, l. c., *f. 2;* M. H. M., *f. 202.*
Exsiccati:—Drumm. Musc. Am. 190 (as *Hypnum confervoides*); Grout, N. Am. Musc. Pl. Suppl. 2.

On shaded subalpine rocks, occasionally on other substrata. Southern Canada, west to British Columbia, south in the mountains to New Mexico and New England. Cheney says "not uncommon locally."

Apparently overlooked and seldom collected. Mrs. MacFadden collected it several times in the Rocky Mt. section of British Columbia where it seems unusually well developed. Some of the setae were 15 mm. long and the opercula strongly apiculate.

4. Amblystegiella minutissima (Sull. & Lesq.) Nichols, Bryol. **11**: 5. 1908.

Hypnum minutissimum Sull. Mosses of the U. S. 78, and Sull. & Lesq. in Sull. Icon. Musc. 195. *pl. 120.* 1864.
Amblystegium minutissimum (Sull. & Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876–77**: 547.

Plants minute, pale green, in thin patches; stems closely appressed to the substratum, subpinnately branching; *leaves linear-lanceolate, distant, not narrowed to the insertion but broadest there,* 0.3–0.4 mm. long, tapering evenly to the apex, serrulate above, nearly or quite ecostate; median leaf cells 40–60 μ long, 4–8 : 1; *marginal alar cells about 2 : 1, scarcely differentiated from the other basal; perichaetial leaves, ovate, long acuminate, coarsely and irregularly dentate above.* Monoicous; seta about 5 mm. long; capsule ovoid, symmetric or slightly curved, *inclined to pendulous, or at times almost erect,* including operculum ± 0.5 mm. long, contracted below the mouth and turbinate when dry and empty; operculum conic-apiculate, ½–1 times the length of the urn; annulus present, large; peristome perfect, with cilia; Spores in summer. Type locality, central and southern Ohio. Type in herb. Sullivant, Cambridge, Mass. (according to Cheney, l. c. 245).

Illustrations:—Sull. l. c.; Cheney, l. c. *f. 4.* M. H. M. *f. 202.*
Exsiccati:—Sull. Musci. Allegh. 31 (in part, as *Hypnum confervoides*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 343, (Ed. 2) 520.

Very rare. On stones, preferably limestone, in moist shaded ravines, ranging, according to Jennings, from "New Jersey and Pennsylvania westward to Illinois, Ontario, the Rocky Mountains and British Columbia."

Sterile, this species is easily confused with *A. Sprucei*, careful observation will enable this species to be distinguished by its non-contracted leaf base and elongated alar cells.

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*See Correns Vermehr. der Laubm. 254.

7. PYLAISIA Bry. Eur. fasc. 46–47. 1851. (Not Desv. 1814.)

Pylaisiella Kindb. Can. Rec. Sci. **1894**: 21. 1894.

Plants in rather thin glossy-green mats. Stems creeping, subpinnately branching; branches short, erect or ascending, more or less recurved at the tips by reason of the strongly secund apical leaves; not radiculose; leaves erect-spreading, somewhat falcate-secund, especially when dry, acuminate, concave, ecostate or costa short and double; leaf cells linear, quadrate at the basal angles. Monoicous; paraphyllia none. Archegonia usually borne on stem; seta smooth, twisted to left above, to right below; calyptra cucullate; capsule erect, seldom slightly incurved; operculum conic or short-rostrate; annulus narrow; peristome double, inserted below mouth of capsule; segments attached to a wide basal membrane, free or adhering to teeth; cilia rudimentary or none.

Type species, *P. polyantha.*

Widely distributed in the north temperate zone.

The generic name *Pylaisia* was first used by Desvaux in 1814 to designate a new genus named in honor of De La Pylaie. The specimen upon which his genus was founded is stated to be nothing more than a depauperate form of *Hypnum denticulatum* L.

In 1851 Bruch and Schimper took up the name for a new genus founded on *Hypnum polyanthos* Schreb. DeNotaris in 1869 extended the genus *Pylaisia* by including *Orthothecium* of the Bry. Eur., and in this extended form it was degraded by Lindberg in 1879 to a subgenus of *Stereodon* of Mitten.

Key.

1.	Segments of the endostome entirely free from the teeth	2.
	Segments partially or wholly adherent to the teeth	4.
2.	Quadrate alar cells numerous, 10–15 along the basal margin	3.
	Quadrate alar cells, 3–9 marginal	*1. polyantha.*
3.	Leaves ovate; operculum short-conic	*2. Jamesii.*
	Leaves ovate-lanceolate; operculum short-rostrate	*3. subdenticulata.*
4.	Segments partially adherent to the teeth; spores 18–24 μ in diameter	*4. Schimperi.*
	Segments wholly adherent; spores 25–30 μ	*5. intricata.*

1. Pylaisia polyantha Bry. Eur. fasc. 46–47. *pl. 455.* 1851.

Hypnum polyanthos Schreb. Spicil. Flor. Lips. 97. 1771.
Pylaisia heteromalla Br. & Sch. Lond. Journ. Bot. **2**: 669. 1843.
Hypnum polyanthum pallidifolium C. Muell. Syn. **2**: 337. 1851.
Pylaisia ontariense C. Muell. & Kindb. Macoun, Cat. Can. Pl. **6**: 174. 1892.
Pylaisiella polyantha (Schreb.) Grout, Bull. Torr. Club, **23**: 229. 1896.

Plants in glossy yellowish green intricate mats; stems 2 to 10 cm. long, rarely longer, creeping, pinnately branching; branches 0.5 to 1 cm. long, erect or ascending; branch leaves somewhat falcate-secund, loosely imbricate when dry, broadly ovate-lanceolate, 1–1.3 x 0.4–0.5 mm., more or less long-acuminate, entire, slightly concave, ecostate, or costa very faint, short and double; leaf-cells linear-rhomboidal; median cells 8 : 1; quadrate alar cells (3–9 along the margins); stem leaves broader, more abruptly acuminate: perichaetial leaves loosely sheathing, squarrose at apex; inner oblong-lanceolate, more or less long-acuminate, more or less serrate at apex, ecostate; cells linear above, rhomboidal and hyaline below. Seta red-brown 1–2 cm. long; capsule lighter red-brown, oblong-cylindric, 2.5 mm. long, 3.5–4 : 1, often stomatose at base; operculum conic to conic-apiculate; annulus very narrow and easily detached, of one row of cells; teeth of peristome linear-lanceolate, closely and regularly articulate, submoniliform and slightly granular above; segments as long as teeth, linear-lanceolate, strongly carinate, more or less split when old, granular-roughened; cilia single, usually rudimentary; spores brownish yellow, minutely roughened, 14 μ, maturing in autumn and winter.

Type locality European.

On trunks and roots of trees. Not common.

Illustrations:—Bry. Eur. l. c.; Husnot. Musc. Gall. *pl. 89;* Limpricht, Laubm. **3**: *f. 354. Pl. 35.*

Exsiccati:—Drumm. Musc. Am. 222; Aust. Musc. Appal. Suppl. 1. 537; Macoun, Can. Musc. 260 (in part) and 264 (as *P. heteromalla*); Grout. N. Am. Musc. Pl. 452 and Musci Perfecti 136; Bartram, Mosses of S. Arizona 51.

Apparently widely destributed in Canada and along the northern border of the United States in mountainous regions, but rather infrequent and local; more frequent in the Northwest; south to Arizona and Alabama.

The typical form of this species is quite variable in leaf characters even on the same plant, but it differs constantly from European specimens in that the leaves are shorter, more abruptly acuminate and more broadly ovate-lanceolate. The length of the leaf of the European form averages 1.5 mm., that of the American 1 mm., though I have found one plant whose leaves measured 1.4 mm. The length of the acumination of the perichaetial leaves is also very variable. It may be found that our forms of this and the next species are but two varieties of the European *P. polyantha.* The American *polyantha* approaches the description of *P. polyantha brevifolia* Lindb. & Arnell, Musc. Asiae- bor. 152. 1890. I have seen the type specimens of *P. heteromalla* from Schimper's herbarium and not only are they *P. polyantha,* but Schimper himself indicated clearly on his labels that he did not consider it a good species; Drummond's no. *222,* on which this species was founded, is evidently somewhat mixed as the Columbia Herbarium specimen is *P. intricata.*

Var. PSEUDO-PLATYGYRIA (Kindb.) **n. comb.**

Pylaisiella polyantha pseudo-platygyria (Kindb.) Grout, Bull. Torr. Club, **23:** 230. 1896.
Pylaisia pseudo-platygyrium Kindb. Macoun, Cat. Can. Pl. **6:** 173. 1892.
Pylaisia filari-acuminata Kindb. l. c. 174.

Leaves narrowly long-acuminate; upper branch leaves distantly serrate-dentate along sides of acumination; inner perichaetial leaves often long-acuminate, serrate-dentate along the acumination; cilia 1 or 2, better developed than in the type.

Type locality, shores of Lake Nipigon, Ontario. Also found on the west side of the Columbia River at Revelstoke, B. C.; Shoreham, Vermont.

On decayed trunks and on "logs subject to inundation."

EXSICCATI.—Macoun, Can. Musc. 626. (*Pylaisia filari-acuminata.*)

Var. BREVIFOLIA Lindb. & Arnell, Musc. Asiae-bor. 152. 1890.

Intermediate between *P. polyantha* (Schreb.) Bry. Eur. and *P. subdenticulata* Schimp. It has the shorter acuminate, subdenticulate leaves and more numerous quadrate alar cells of the latter and the conic operculum and rudimentary cilia of the former. I have not seen authentic Old World material of this variety, but the New Mexico plant corresponds well with the description in Limpricht's Laubmoose **3:** 12. It may well prove to be a new variety when more material is available.

Cloudcroft, Sacramento Mts., Otero Co., New Mexico, Aug. 8, 1899. E. O. Wooton.

2. PYLAISIA JAMESII Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 383. 1865.

Pylaisiella polyantha Jamesii (Sull.) E. G. B. Bull. Torr. Club. **23:** 230. 1896.
Pylaisia subdenticulata obscura Lesq. & James, Manual. 309. 1884.

Leaves ovate to broadly ovate, entire, gradually acute, or in the largest leaves (reaching 1.3 x 0.5 mm.) ending in a rather abrupt acumination of varying length; median leaf cells oblong to oblong-linear, about 7 μ wide, 3–6 : 1; quadrate alar cells numerous (10–15 marginal). Sporophyte scarcely to be distinguished from that of *P. polyantha.* Pl. 37.

Type from Chelsea, Mass. (James).

The type collection is apparently a poorly developed form of the specific type, as it is smaller than *polyantha* with teeth of peristome shorter than the segments. The fully developed western form is as large as *polyantha* with longer peristome teeth. It has been collected in Nebraska, S. Dakota, Minnesota, Iowa and New Mexico. Apparently growing on the bark and roots of trees. This species has the alar cells of *subdenticulata* and the operculum of *polyantha.* Probably all three would better be regarded as variants of one species.

3. PYLAISIA SUBDENTICULATA Schimp. Bry. Eur. fasc. 46–47. 1851.

Pylaisiella subdenticulata (Schimp.) Kindb. Can. Rec. Sci. **1894:** 22. 1894.
Pylaisia denticulata Sull. in A. Gray, Man. (Ed. 2) 52. 1856.

Plants darker green than the last, scattering or in thin mats, often closely intermixed with other species; stems 1–3 cm. long, irregularly divided, subpinnately branching; branches very short, usually less than 5 mm. long; branch leaves erect-spreading, ovate-lanceolate, 0.7–1 x 0.2–0.35 mm., gradually long-acuminate, more or less denticulate, especially above, concave, ecostate or costa thin, short or double; median cells

6–8 : 1; quadrate alar cells numerous (10–15 marginal); perichaetial leaves 1.5–2 mm. long, loosely sheathing; inner ovate-lanceolate, gradually or abruptly narrowed to a long point, more or less denticulate above, ecostate. Seta 8–17 mm. long, brown; capsule brown, cylindric, 1.5–2 mm. long, 4–5 : 1; operculum conic, short-rostrate; annulus very narrow, consisting of a row of isodiametric polygonal cells and a row of vesicular cells that often come off with the operculum; teeth of peristome linear-lanceolate, orange, closely and regularly articulate, submoniliform and granulose above; segments linear-lanceolate, a little longer than the teeth, more or less split above; cilia lacking; spores yellow-brown, minutely roughened, 10–12 μ, maturing in summer or early autumn.

Type locality American (Sullivant).

On trees. New York and New Jersey; Maryland; Jasper, Canada; Ohio; Athens, Ill.; New Mexico; Minnesota; Wisconsin; North Carolina.

Illustrations.—Sull. Icon. Musc. *pl. 87; Pl. 37.*

Exsiccati.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 382; Aust. Musc. Appal. 290. Very close to *P. polyantha*, but distinguished by the reduced size, rostrate operculum, absence of cilia and numerous quadrate alar cells.

4. Pylaisia Selwynii Kindb. Ottawa Nat. **2**: 156. 1889.

Pylaisia intricata Sch. Bryol. Eur. Fasc. 46–47: Pylaisia 2. 1851, as to plant described. Sulliv. Mosses U. S. 62. 1871. Lesq & James. Man. 309. 1884.
Hypnum intricatum C. Müll. Syn. Musc. **2**: 338. 1851.
Pylaisiella intricata Grout, Bull. Torrey Bot. Club **23**: 231. 1896.
Pylaisia Schimperi Cardot, Bull. Herb. Boiss. I. **7**: 373. 1899.

Plants in wide glossy-green intricate mats; stems 5–8 cm. long, creeping, pinnately branching; branches about 5 mm. long, erect or ascending, strongly recurved at tips, especially when dry; branch leaves secund, especially at the ends of the branches, ovate-lanceolate, 0.8–1.1 x 0.3–0.4 mm., more or less long-acuminate, entire or subdenticulate at apex, concave, ecostate or costa short, thin and double; median cells linear-fusiform, 7–12 : 1; quadrate alar cells numerous, (15–20 marginal) bordering the lower ⅓ of leaf; stem leaves ovate to broadly ovate-lanceolate, more abruptly acuminate, costa short and double; leaf-cells broader, linear-rhomboidal; inner perichaetial leaves 2–2.5 mm. long, loosely sheathing, oblong-lanceolate, acuminate, denticulate above, costa diffuse, reaching middle; leaf-cells linear above, looser, rhomboidal and strongly porose below. Seta 12–17 mm. long, dark red-brown; capsule red-brown, ovoid to ovoid cylindric, symmetric, slightly narrowed at mouth, 2 mm. long, 3–4 : 1; operculum conic, erect or oblique; annulus of about 2 rows of cells; teeth of peristome subulate-lanceolate, closely and regularly articulate, light yellow-brown; segments longer than the teeth, adherent for ⅔ their length, split below, united above; spores yellow-brown, minutely roughened, thick walled, 18–24 μ, maturing in autumn.

Type locality American.

Illustrations:—Sull. Icon. Musc. *pl. 88;* M. H. M. *pl. 85.*

Exsiccati:—Sull. Musc. Allegh. 34; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 256, (Ed. 2) 380; Macoun, Can. Musc. 262 & 434 ; Ren. & Card. Musc. Am. Sept. Exsic. 89; Aust. Musc. Appal. 291 & 292; Grout, N. Am. Musc. Pl. 3, and Musci Perfecti 85.

Common in the United States and Canada east of the Rockies, south to Florida; Arizona, Bartram.

Austin's 292 is the type of a form with ovate leaves and much more numerous quadrate alar cells, extending along ½ the length of leaf margin. It grew on stone fences (in part), in dry exposed situations; median leaf cells 5–6 : 1; apical oblong-rhomboidal 2–3 : 1. It is approached by Kindberg's *P. Selwynii.*

This species is easily distinguished by its curved branches, numerous quadrate alar cells and partially adherent segments. It varies a great deal in length of leaves and in length of leaf-cells, length and color of capsule and size of spores. Authentic specimens of *Pylaisia Selwynii* Kindb. show that it is merely a form of this species growing in exposed dry places. The plants are darker and the leaves more strongly recurved than usual.

5. Pylaisia intricata (Hedw.) Sch. Bryol. Eur. Fasc. 46–47: Pylaisia 2. 1851. (as to the cited synonym only). Card. Bull. Herb. Boiss. I. **7**: 373. 1899.

Pterigynandrum intricatum Hedw. Sp. Musc. 85. *pl. 18. f. 1–5.* 1801.
Pterogonium intricatum Schwaegr. in Hedw. Suppl. **1**[1]: 100. 1811.
Pylaisia velutina Sch. Bryol. Eur. Fasc. 46–47: Pylaisia 3. 1851.

Plants in wide glossy yellow-green mats; stems 5 cm. or more long, creeping; branches 5–10 mm. long, ascending, curved at tip; branch leaves loose, secund, especially when dry, ovate-lanceolate, 0.8–1.2 by

0.3 mm., more or less long-acuminate, entire or denticulate along the somewhat involute margin, concave, ecostate, or costa short, faint and double; median cells linear-fusiform, 8–10 : 1; quadrate alar cells few (less than 10 marginal); stem leaves much broader; inner perichaetial leaves 2 mm. long; loosely erect, oblong-lanceolate, long-acuminate, somewhat denticulate at apex; leaf-cells linear above, linear-rhomboidal and porose below. Seta 1.2–1.7 cm. long, brown; capsule brown, ovoid-cylindric, 2 mm. long, 4 : 1; operculum conic, strongly apiculate to short-rostrate; annulus narrow, of 2 rows of cells; teeth of peristome yellow-brown, linear-lanceolate, very closely articulate, bordered the entire length by the adhering segments; spores thick-walled, finely papillose, dark yellow-brown, 24–30 μ, maturing in late summer or early autumn.

Type locality Lancaster, Pennsylvania.

On bark of trees, old logs, etc.; New Brunswick, and Mt. Desert, Maine; south to North Carolina, west to Ohio and Indiana, Minnesota; Arizona, Bartram.

Illustrations.—Sull. Icon. Musc. *pl. 89;* M. H. M. *f. 209.*

Exsiccati.—Sull. Musc. Allegh. 60; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 257, (Ed. 2) 381; Aust. Musc. Appal. 293 & 294; Macoun, Can. Musc. 470; Grout, N. Am. Musc. Pl. 188.

Distinguished from *P. Selwynii* by the entirely adherent segments, narrower leaves with fewer quadrate alar cells, and larger spores.

Cardot in studying Hedwig's types discovered that Hedwig's *Pterigynandrum intricatum* was identical with Schimper's *Pylaisia velutina* instead of *Pylaisia intricata* Schimp. Hence the changes of name.

8. PLATYGYRIUM Bry. Eur. fasc. 46–47. 1851.

Plants of small to medium size, with creeping irregularly branched stems; leaves equally spreading to rarely somewhat secund, ovate to oblong-lanceolate, acute to acuminate, ecostate or with short and double costa; median leaf cells broadly to narrowly linear; quadrate alar cells numerous. Dioicous; capsule erect, nearly or quite symmetric; operculum short-rostrate; peristome teeth narrow; inner peristome without cilia; segments narrow, linear. Type species *P. repens.*

Differs from *Pylaisia* chiefly in having the leaves not secund or falcate (*slightly secund in fuscolutescens*), and the very narrowly linear segments of the inner peristome.

Key.

Plants growing on bark of trees or on wood; leaves less than 1.5 mm. long..... *1. repens.*
Plants growing on rocks; leaves more than 1.5 mm. long..... *2. fuscoluteum.*

1. Platygyrium repens (Brid.) Bry. Eur. fasc. 46–47. *pl. 458.* 1851.

Pterigynandrum repens Brid. Musc. Recent. Suppl. **1**: 131. 1806.
Pterogonium repens Schwaegr. Suppl. **1**[1]: 100. *pl. 27.* 1811.
Neckera repens Schwaegr. Suppl. **3**[1]: Sect. 2. *pl. 246.* 1828.
Cylindrothecium repens De Not. Epil. 214. 1869.
Entodon repens (Brid.) Grout, Bull. Torr. Club, **23**: 227. 1896.

Plants in rather thin intricate mats, varying from dark green to a lighter yellowish green; stems 2–6 cm. long, prostrate; branches short, cylindric, ascending, often slightly curved; ends of sterile branches often bearing numerous small bud-like gemmae in the axils of the leaves; leaves oblong-ovate to oblong-lanceolate, closely imbricate when dry, 0.7–1.2 mm. long by 0.3–0.4 mm. wide, acute to acuminate; margins recurved and entire; costa lacking or short and double in robust plants; apical cells rhomboidal, median linear, 8 : 1; quadrate alar cells numerous (8–12 marginal) and extending up the margin of leaf; stem leaves larger and proportionately broader: perichaetium 1.5 mm. long, sheathing below, spreading above; inner leaves oblong, long-acuminate, denticulate at apex, usually with a short thin double costa, upper cells linear, alar enlarged and rectangular. Dioicous: seta brown, 1–2 cm. long; capsule erect, about 3 mm. long, 4 : 1, brown; operculum long-conic to conic-rostrate; annulus of about 3 rows of small cells resembling the upper exothecial cells; peristome teeth linear-lanceolate, hyaline-margined (margin often lacking in immature plants), with raised lines at the base but without the fine cross striae at base characteristic of most hypnaceous peristomes; segments linear, usually free at base, nearly as long as teeth often split between joints; spores minutely roughened, maturing in early autumn.

Type locality, Switzerland.

On bark of trees, decaying logs and stumps. Europe, and North America east of the Rocky Mountains. Common.

ILLUSTRATIONS:—Schwaegr. l. c.; Br. & Sch. l. c.; Husnot, Musc. Gall *pl. 89;* Limpr. Laubm **3**: *f. 353;* M. H. M. *f. 208.*

EXSICCATI:—Drumm. Musc. Am. (S. States) 98 and Musc. Am. 159 (*Neckera sericea*). Sull. Musc. Allegh. 45 (*Neckera sericea*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 259, (Ed. 2) 385; Austin, Musc. Appal. 281; Ren. & Card. Musc. Am. Sept. Exsic. 235; Grout, N. Am. Musc. Pl. 151 & 360.

In a swamp in N. Carolina I collected a robust form with long acuminate branch leaves that were occasionally slightly serrulate at apex.

Var. ORTHOCLADOS Kindb. Macoun, Cat. Can. Pl. **6**: 172. 1892.

Entodon repens orthoclados (Kindb.) Grout, Bull. Torr. Club **23**: 227. 1896.
Platygyrium repens sciuroides Limpr. Laubm. **3**: 7. 1896.
Platygyrium repens ramulis elongatis Bry. Eur. *pl. 458. f. 3.*

Glossy yellowish green. Branches much larger and longer; leaves larger, 1.2 x 0.4 mm., loosely imbricate, shortly bicostate.

Type from Skead's Farm near Ottawa (Macoun).

EXSICCATI:—Sauter in Breut. Musc. Frond. Exsic. 296; Macoun, Can. Musc. 259 in part.

This variety seems to me to be only a robust form of a variable species. It was not considered by Schimper as worthy of varietal rank, although he figures the form. I have seen Dr. Sauter's type and also Kindberg's and they are without doubt the same. Kindberg's criticisms in Macoun's Catalogue on the descriptions and plates of this species are entirely without point. The Columbia College specimens of Macoun's no. 259 contained no fragment of *Platygyrium*, but consisted of *Pylaisia polyantha.*

Var. ASCENDENS (Schwaegr.) **n. comb.**

Pterogonium ascendens Schwaegr. Suppl. 3, **1**[2]: *pl. 243.* 1828.

Distinguished from typical forms by the following characters more robust, branches more erect, julaceous; leaves closely imbricated, short-acuminate; the alar cells generally smaller, the marginal ordinarily elongated transversely; seta very slender; capsule smaller. The above description is translated from Cardot's description of the type in Bull. Herb. Boiss. **7**: 375, *pl. 8.* 1899, and his figures are reproduced in *Pl. 44.* From his figures and description drawn from the type it seems evident that *Pterogonium ascendens* is merely a robust variety of *Platygyrium repens* with leaves unusually short-acuminate. Specimens very closely approximating Cardot's figures have been collected in Pine Hollow, Iowa, by Dr. Conard and doubtless are not rare.

I am morally certain it should not be confused with the preceding variety, as leaves from Kindberg's type have almost the extreme of slenderly acuminate leaves that are found in the species.

I think, also, that Bridel's *Pterigynandrum brachycladon* should be left out of account, for in Bryol. Univ. **2**: 185. 1827, he cites Schwaegrichen's *plate 110*, which represents *Homalotheciella subcapillata* (Hedw.) Card. and describes his plants as "*nervo * * brevissimo obsoletissimo saepius in rameis nullo*"!! See Bryologist **5**: 11. 1902.

2. PLATYGYRIUM FUSCOLUTEUM (Schimp.) Card. Rev. Bryol. **38**: 40. 1911 and **35**: 49. 1910.

Plants brownish green, in wide close, rather thin mats; stems prostrate, 4–5 cm. long, irregularly branching, branches suberect; leaves erect-open when moist, more appressed *and more or less secund when dry*, oblong-lanceolate to ovate-lanceolate, concave, entire, rather abruptly narrowed to a tapering acumination averaging about ½ the length of the body of the leaf; margins recurved to the base of the acumination; costa short and double or lacking; *stem leaves reaching 2 x 0.5 mm.;* branch leaves shorter and relatively broader; median leaf cells linear, about 7 μ wide, 8–10 : 1; basal and apical cells shorter; quadrate alar cells numerous (10–15 on the margin) and reaching half way to the leaf middle, the lower marginal larger, the upper smaller and transversely elongated and obscure. Apparently dioicous; seta and capsule light brown; seta rather more than 1 cm. long; capsule oblong-cylindric, with operculum about 3 mm. long; operculum rostrate, about 0.7 mm. long; annulus present; peristome much like that of *P. repens* except that the linear segments are not usually open between the articulations; spores in winter (February). Type locality Orizaba, Mexico. The leaves in the type are more shortly acuminate than in most American specimens.

ILLUSTRATIONS:—*Pl. 42, F.*
EXSICCATI:—Bartram, Mosses of S. Arizona 123 and 40 (as *P. repens*); Grout, N. Am. Musc. Pl. 497.
On rock face, White Horse Canyon, Santa Rita Mts., Arizona, Bartram.
Sacramento Mts., N. Mexico, Wooton.

Bartram's moss seems certainly to be a *Platygyrium*, very distinct from *P. repens* in color, size, alar cells and habitat. N. Am. Musci Pl. 414 is a stunted gemmiferous form of *P. fuscoluteum* that in some plants has the alar cells of *repens*, but its color, habitat and best developed leaves show its affinity to *fuscoluteum*. Microscopically it is an intermediate form with leaves scarcely larger than in robust *repens* (From Black Mts. Grant Co., New Mexico, Holzinger).

9. TAXITHELIUM Spruce, Cat. 1867.

Plants slender to moderately robust, growing in flat tufts; paraphyllia lacking; leaves mostly close, more or less concave, dorsal and ventral smaller, mostly finely serrate; costa lacking; median leaf cells mostly prosenchymatous, usually bearing several papillae in a row over the face of the cell on the back; alar cells differentiated. Seta mostly smooth; capsules more or less inclined, ovoidal, unsymmetric, contracted under the mouth when dry and empty; peristomes perfect, opercula conic to conic-apiculate. 95 species, tropical and subtropical, only one of which comes within our range.

TAXITHELIUM PLANUM (Brid.) Mitt. Jour. Linn. Soc. **12**: 496. 1869.

Hypnum planum Brid. Musc. Rec. Suppl. **2**: 97. 1812.

Plants bright green, growing in rather thin loose patches; stems 1–3 cm. long, prostrate, radiculose below, more or less regularly and pinnately branched, somewhat complanately foliate; cortical cells rather large and clear; stem leaves loosely imbricate when dry, erect-open when moist, 0.9–1.1 mm. long, 0.4–0.5 mm. wide, ovate, acute to short-acuminate, concave, narrowed and somewhat decurrent at the insertion, entire to crenulate-serrate above; median leaf cells narrowly linear-flexuose, about 5 μ wide, 12–15 : 1, each with a row of minute papillae down the middle of the dorsal side; at basal angles a small group (2–6 marginal) of broader clear rectangular to quadrate alar cells; branch leaves smaller and more serrulate; perichaetial leaves nearly or quite smooth, the inner long-acuminate. Monoicous; seta reddish to orange, very slender, ± 1.5 cm. long; capsule small, with a short neck, ovoid, including neck and operculum less than 1 mm. long, horizontal, unsymmetric, contracted under the mouth when dry; operculum depressed-conic, long-apiculate; annulus apparently lacking; peristome perfect, with single cilia; spores in late summer. Type from Porto Rico.

ILLUSTRATIONS:—Schwaegr. Suppl. 3; *pl. 280; Pl. 42D.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 368.
On decaying wood and base of trees. Not rare in Florida, especially in the southern portion.

10. MITTENOTHAMNIUM Hennings, Hedwigia **41**: 225. 1902.

Microthamnium Mitt. Jour. Linn. Soc. **12**: 503. 1869. Not *Microthamnium* Naegli in Kützing Spec. Alg. 352. 1849.
Stereohypnum (Hampe) Fleisch. Hedwigia **47**: 273. 1908.

Plants slender (in our species), in rather loose mats; leaves spreading from an ovate, cordate or triangular base, acuminate; margins plane and serrulate; costa short and double or lacking, occasionally one branch reaching ½ the length of the leaf; leaf cells short-linear, papillose on the back by projecting cell angles as in *Bryhnia;* differentiated alar cells present, usually small and subquadrate; branch leaves smaller, more shortly acuminate and more strongly serrate. Capsules small, ovoid to cylindric; peristome usually perfect with one or two cilia.

MITTENOTHAMNIUM DIMINUTIVUM (Hampe) E. G. B. Bryol. **17**: 8. 1914.

Hypnum diminutivum Hampe, Linn. **20**: 86. 1847.
Hypnum cubense C. Muell. Syn. **2**: 267. 1851.
Hypnum thelistegum C.Muell. l. c. 269.
Hypnum squamulosum C. Muell. Bot. Zeit. **14**: 440. 1856.
Hypnum perspicuum Hampe, Linn. **31**: 529. 1862.
Hypnum campaniforme Hampe, Warming Videnok, Medd. Nathist For. Kjöbenhaur **1870**: 289. 1870.
Ctenidium diminutivum Fleisch. Hedw. **47**: 291. 1908.

Plants pale green to yellowish; stems irregularly to pinnately branched, slender, 1–2 cm. long; branches 2–5 mm. long; leaves spreading, small; stem leaves ± 0.6 mm. long, ovate, acuminate, concave, clasping

and slightly decurrent at base; costa short and double or lacking (occasionally one branch reaching ½ the length of leaf); margins plane and serrulate; median leaf cells oblong-linear, about 5 μ wide, 4–7 : 1, papillose at back by the excurrent angles; a few alar cells denser and quadrate; perichaetial leaves short, scarcely covering the vaginule. Monoicous; seta 7–12 mm. long; capsules less than 1 mm. long, cernuous to drooping, ovoid, contracted under the mouth when dry and empty; operculum rounded-conic, apiculate; peristome perfect; spores in winter. Type locality, on rotten logs, Caracas, *Moritz no. 20.*

Illustrations:—Fleisch. Hedwigia **47**: 291, *f. 10; pl. 42. C.*
Exsiccati:—Grout, N. Am. Musc. Pl. Suppl. 8, also largely mixed with no. 483; Aust. Musc. Appal. Suppl. 545.
Bases and roots of trees and decaying wood, southern Florida, Mexico and West Indies to South America.*
This species might easily be mistaken for *Campylium hispidulum* but for the longer and more slender acumination of the leaves and the leaf cells papillose at back.

11. TRIPTEROCLADIUM (C. Muell.) Kindb. Eur. & N. Am. Bryin. **1**: 31. 1896.

Hypnum sect. *Tripterocladium* C. Muell. Flora **58**: 79. 1875.

One species.

Tripterocladium leucocladulum (C. Muell. l. c.) Kindb. l. c.

Hypnum compressulum C. Muell. l. c. 80.
Platygyrium rupestre Kindb. Bull. Torr. Bot. Club. **17**: 276. 1890.

Plants brownish-green, in wide loosely intertangled mats; *stems very slender to filiform*, rather stiff, reaching 5 cm. or more in length, pinnately branched; *branches filiform, subjulaceous, attenuate*, more or less in the same plane but irregularly placed, the upper median branches longest, reaching 15 mm. in length and often with pinnately arranged branchlets; pseudo-paraphyllia occasional in the leaf axils; stem and branch leaves loosely appressed when dry, slightly open-erect when moist; stem leaves ovate to oblong-ovate, ± 1.25 mm. long, rather gradually narrowed to an acumination of varying length and slenderness, entire or slightly serrulate above, *somewhat narrowed to the decurrent insertion; margins more or less recurved near the base;* median leaf cells 5–7 x 30–50 μ, linear, rather thick-walled, marginal shorter, none papillose; basal shorter; *small thick-walled alar cells numerous, quadrate to irregular*, extending 0.2–0.3 mm. up the margin and half way to the middle of the leaf base at the insertion; *costa variable even on the same plant, single and reaching almost to the leaf middle or much oftener double and shorter, sometimes almost lacking; branch leaves smaller*, with a shorter and broader acumination which is *usually irregularly serrate above;* leaves of branchlets much smaller and more sharply serrate; perichaetial leaves sheathing, the inner with a long serrate acumination which is more or less spreading. Monoicous; seta about 15 mm. long; urn of capsule from 1.25 to 2.5 mm. long, nearly erect and symmetric to strongly curved and horizontal, both forms found in the same tuft; peristome perfect, cilia single. Type locality, Oakland, Oregon (Harvey).

Illustration:—*Pl. 42.*
Exsiccati:—R. & C. Musc. Am. Sept. Exsic. 240.
Specimens of *Platygyrium rupestre* from the type locality and cotypes of both *T. leucocladulum* and *T. compressulum* at the New York Botanical Garden have been carefully studied and compared with all the available material of the genus. Any characters given in the original descriptions of the others can be duplicated in *T. leucocladulum* and often many of them in the same tuft. *P. rupestre* seems to be a form with extremely attenuate, little-branched stems, while *T. compressulum* has the branches less attenuate than in the type of *T. leucocladulum.* This species seems almost as variable along some lines as *Pseudisothecium stoloniferum*, from which its slenderness and the short and double costa at once distinguish it. Leiberg and Henderson have made several collections in Idaho. It will probably be found in collections from the Rocky Mt. region, as the inaccurate descriptions have made it very hard to identify.

12. VESICULARIA (C. Muell.) C. Muell. Flora **82**: 467. 1896.

Omalia subsec. I, *Vesicularia* C. Muell. Syn. **2**: 233. 1851 (in part).

Plants slender to robust, in wide thin mats; stems elongated, creeping, simple or divided, more or less regularly pinnately branched; *leaves not decurrent, differentiated into dorsal, lateral and ventral;* the lateral erect or slightly secund, rarely falcate-secund, sometimes broadly ovate, sometimes ovate-lanceolate or oblong-lanceolate, shortly acuminate or long filiform-acuminate; costa short and double; *leaf cells, oval- to*

* In the above I have drawn largely on Mrs. Britton's articles, Bryol. **6**: 59 & **17**: 8.

oblong-hexagonal or even elongated rhomboid-hexagonal, often elongated in marginal row and forming a distinct border; alar cells not differentiated; dorsal and ventral leaves much smaller. Seta 1–2.5 cm. long, smooth; *capsule horizontal to drooping, broadly ovoid to oblong-ovoid, usually symmetric* and often contracted under the mouth when dry and empty; annulus present, peristome normal hypnoid; operculum convex to conic-apiculate, rarely short-rostrate. Exclusively tropical and subtropical. Found in the U. S. in southern Florida only and rare even there. Formerly included in *Ectropothecium*, from which it differs mainly in the broad loose areolation, much like that of some species of *Bryum*.

KEY.

1. Lateral leaves plainly falcate-secund, slenderly long-acuminate ..... *3. crassicaulis.*
   Lateral leaves not falcate, scarcely or not at all secund,* acute to short-acuminate... 2.
2. Marginal cells of upper ½ of leaf much narrower than the median..... *2. amphibola.*
   Marginal cells only slightly different from the median..... *1. vesicularis.*

1. VESICULARIA VESICULARIS (Schwaegr.) Broth. Engler & Prantl, Musci (Ed. 1) **2:** 1094. 1908.

Hypnum vesiculare Schwaegr. Sp. Musc. Suppl. **2:** 167. *pl. 199.* 1827.
Leskia (Omalia) rutilans Brid. Bryol. Univ. **2:** 332. 1827 (except var. *portoricensis*).
Ectropothecium vesiculare (Schwaegr.) Mitt. Jour. Linn. Soc. **12:** 518. 1869.
Ectropothecium rutilans (Brid.) Mitt. l. c. 519.
Vesicularia malachita (C. Muell.) Hedwigia, **37:** 251. 1898.

Plants in wide thin intricate mats, bright to yellowish green, brownish below; stems slender, prostrate, with branching irregular to subpinnate; branches arcuate, simple or with few short branchlets; dorsal and lateral stem leaves spreading, when dry imbricate and erect-open, broadly oblong-ovate to triangular, acuminate; margins nearly or quite plane and entire, rarely minutely denticulate at apex; upper leaf cells pellucid, hexagonal, about 30–40 x 22–25 μ; ventral stem leaves smaller, concave, broadly oblong, cells in the upper part of the leaf, narrower; dorsal and lateral branch leaves subdistichous, spreading, when dry more or less crisped, ovate to rounded-ovate, shortly and abruptly acuminate, often unsymmetric at base, entire except at the very apex; costa short and double, often indistinct; cells about 29 x 25–30 μ, hexagonal to subhexagonal, gradually longer toward the base; ventral branch leaves much smaller and narrower, triangular-ovate, short-acuminate; cells elongate-hexagonal, about 15–20 x 40–50 μ; inner perichaetial leaves about 1.5 mm. long, ovate to oblong, filiform-acuminate, ecostate. Monoicous; male buds on the stem near the female; seta 1–1.5 cm. long "purple," smooth; capsule short-oblong, horizontal to pendent, contracted below the mouth when ripe and dry, 0.75–1 x 0.5–0.6 mm., rarely one fourth larger; operculum conic-apiculate; peristome perfect; cilia 2–3, often united at base. Type from Jamaica, W. I.

ILLUSTRATIONS:—Schwaegr. l. c.; Salmon, Bull. Torr. Bot. Club. 31: *plates 13 & 14.* 1904; *Pl. 38.*
Over various substrata in hammocks in southern Florida, Small and Grout, also Sanford, Rapp. West Indies and South America.

Var. POEPPIGIANA (Hampe) Broth. l. c.

Hookeria Poeppigiana Hampe, Icon. Musc. *pl. 4.* 1844.
Hypnum Montagnei Schimp. ex Monti in La Sagra, Hist. Cuba, Bot. 530 (in part). 1842.
Hypnum conostegum C. Muell. Syn. **2:** 242. 1851 (except synonymy and Porto Rican habitat).
Ectropothecium flavoviride Mitt. Jour. Linn. Soc. **12:** 518. 1869.

Stem leaves erect-spreading, often somewhat hooked at apex; the dorsal and lateral oblong to ovate, acuminate, about 1.5 mm. long, acumination slender and flexuous; lateral leaves unsymmetric at base; upper leaf cells hexagonal or subhexagonal, 50–70 x 12–15 μ; basal longer, hexagono-rectangular; ventral leaves smaller, about 1 mm. long, slenderly and more abruptly acuminate from a broadly ovate or subquadrate base; branch leaves scarcely complanate, in several rows, often more or less hooked at apex, the dorsal and lateral about 1 mm. long, gradually acuminate; lateral more narrowly ovate-lanceolate, often unsymmetric at base, acumination shorter; upper cells more narrowly hexagonal to subhexagonal, 45–60 x 12–15 μ, marginal in the upper part of leaf rather broader than the others; ventral branch leaves smaller, oblong, ovate, or ovate-lanceolate. Hammocks, southern Florida, Small.

ILLUSTRATIONS:—Hampe, l. c.; Salmon, l. c.; *Pl. 38.*
Rare. Distinguished from the typical form by the longer more gradually acuminate dorsal branch

* Except in *V. vesicularis Poeppigiana.*

leaves with broader marginal cells in the upper part, also by the more or less hooked dorsal and lateral leaves. Salmon states "From all forms of the variable *Ectropothecium amphibolum* Spruce, var. *Poeppigianum* may be at once distinguished by the less denticulate dorsal and ventral branch leaves, with wider marginal cells towards the apex of the leaf and by the wider areolation of the ventral branch leaves."

2. VESICULARIA AMPHIBOLA (Spruce) Broth. l. c.

Ectropothecium amphibolum (Spruce Ms.) Mitt. Jour. Linn. Soc. **12**: 519. 1869.

Similar in many respects to the closely related *V. vesicularia*. Salmon says "Unless careful attention is paid to certain points the present species" (i. e. *V. vesicularia*) "is very likely to be confused with *E. amphibolum*. *E. vesiculare* type may usually be known by its smaller size, and more compact habit, with branches more complanate, spreading at right angles, and more or less arcuate; it is, however, by certain characters shown invariably by the branch leaves that the two species are best distinguished. In *E. vesiculare* the ventral branch leaves are broadly ovate-acuminate, and the areolation is lax, with hexagonal and subhexagonal cells measuring 15–20 x 40–50 μ. In *E. amphibolum* the ventral branch leaves are more longly acuminate from a narrower ovate base, or are sometimes ovate-lanceolate; the areolation is narrow, with subprosenchymatous cells measuring 15 x 80–100 μ. The dorsal and lateral branch leaves, also, of the two species show constant differences. In *E. vesiculare* the leaves are subentire, the margin being minutely denticulate only at the extreme apex; and the areolation of the leaf in the upper half is remarkably lax, with the marginal cells wide. In *E. amphibolum* the margin is more evidently denticulate for a greater distance below the apex; the areolation is decidedly less lax, and the marginal cells are distinctly narrower than the rest, often forming a kind of indistinct border, which is most evident when the leaf is viewed under a low magnification."

ILLUSTRATIONS:—Salmon, l. c.; *Pl. 38*.

Hammocks, southern Florida, Mrs. Britton, no. 611; Small, nos. 1399 & 1397. Also in West Indies and Brazil. Rare in Florida and probably vanishing.

3. VESICULARIA CRASSICAULIS (Mitt.) Broth. l. c.

Ectropothecium crassicaule Mitt. l. c. 517.

According to Salmon this species "is (as the type specimen in Mitten's herbarium shows) different from all the plants described above, and presents the following characters. The plant is straw colored, with here and there branches showing a rich fuscous tinge of color; the stem is closely pinnate, with branches of unequal length which are usually curved at the apex. The stem leaves are very crowded, and seen from the dorsal side of the stem are imbricate in several rows. They are gradually long-acuminate from a truncate broadly ovate or oblong base, the acumen is long, fine and flexuous, the margin is entire (with the marginal cells very distinct) except in the acumen where it is obscurely and minutely denticulate or subentire. The areolation is lax, with hexagonal or elongate-subhexagonal cells, the walls of which become subporose. The ventral stem leaves are smaller and wider, and the cells have thinner walls. They are suddenly acuminate from a subquadrate or broadly oblong truncate base; the acumen is long and usually filiform, and is often flexuously contorted. The points of all the stem leaves are *regularly hamate, being curved towards the ground. The branch leaves are crowded, and strongly hamate;* the dorsal branch leaves are lanceolate and ovate-lanceolate, attenuated to a fine acumen; the margin is entire below, minutely denticulate above; the cells are lax, and hexagonal in shape. The ventral branch leaves are smaller, and more abruptly acuminate from a broadly oblong or subquadrate base; the cells are more delicate, hexagonal in shape, but longer; the acumen is long and fine. Seta about 2 cm. long; capsule pendulous. The habit is very *hypnoid*, and in the regularly hamate leaves, all turned in one direction (so that the dorsal surface of the stem and branches has a smooth or almost glossy appearance, while viewed from below the stem and especially the branches bristle with the flexuose arcuate points of the leaves) the plant recalls such species as *Hypnum cupressiforme*" "Mitten's type is labeled '120 *Hypnum Montagnei* Schimp. in Mont. Crypt. Cuba, p. 530, *t. 20*. Hab. decayed logs in forests, Cuba, Wright, ex parte.' "

Collected in Nixon & Goodwin Hammocks, Dade Co., Florida, Small, no. 6252, Det. R. S. Williams. Also no. 5132 from Timm's Hammock.

13. ECTROPOTHECIUM Mitt. Jour. Linn. Soc. **12**: *22*. 1869 (in part).

A large genus of tropical and subtropical mosses differing from *Vesicularia* (which was included in it by earlier authors) chiefly in the narrower leaf cells, fusiform-rhomboidal to linear-fusiform.

ECTROPOTHECIUM CALOOSIENSE (Aust.) E. G. B. Bryol. **7**: 50. 1904.

Hypnum (*Rhynchostegium*) *caloosiense* Aust. Bot. Gaz. **4**: 161. 1879.

Plants in loose patches, dark- to yellow-green; stems prostrate, 5–8 cm. long, subpinnately branching; paraphyllia present, long-subulate; leaves subcomplanate, wrinkled and shrunken when dry, ± 1 x 0.4 mm., ovate, acute to short-acuminate, more or less serrulate above; margins plane or broadly incurved toward the base; costa double sometimes reaching nearly ½ the length of the leaf; leaf cells linear-fusiform, 5 x 54 μ; two or three alar decurrent; perichaetial leaves clasping below, inner serrate with coarse irregular teeth and suddenly contracted into a slender subulate recurved tip, which is only slightly toothed. Monoicous; seta about 2 cm. long; capsule ovoid, pendulous, strongly contracted under the mouth when dry and empty; exothecial walls with inflated mamillose cells; peristome perfect, papillose; cilia 1 or 2 slender. Type from "Low Hammocks along the Caloosahatchie River, Florida, March, 1878, J. D. S. and C. F. A." *Pl. 39.*

Type seen. The only other collection seems to be that of Rapp, at Tampa, issued as N. Am. Musc. Pl. 477.

Austin describes the leaves as entire or obsoletely serrulate above, but the leaves in the type are mostly markedly serrate above as shown in the figure.

Distinguished from *Plagiothecium micans* by its darker color, broader leaf cells and the pendulous capsule.

Subfamily STEREOPHYLLEAE.

14. STEREOPHYLLUM Mitt. Musc. Ind. Or. 117. 1859.

Plants slender to rather robust; stems creeping with more or less numerous rhizoids on the under side, irregularly to subpinnately branching, usually complanate-foliate; leaves, especially the lateral, more or less unsymmetric, ovate- to oblong-lingulate, ovate-lanceolate, oblong or elliptic, acute or obtuse, mostly with plane entire margins, sometimes serrulate above; costa extending to the leaf middle or beyond; leaf cells rhombic to linear, smooth or papillose; quadrate alar cells numerous; capsules mostly cernuous to horizontal and unsymmetric, ovoid, often contracted below the mouth when dry and empty; annulus usually present, broad; peristome perfect, usually with well-developed cilia.

KEY.

Median leaf cells linear-fusiform, smooth ..... *1. Donnellii.*
Median leaf cells rhombic, more or less papillose ..... *2. Wrightii.*

1. STEREOPHYLLUM DONNELLII (Aust.) Card. Mem. Torr. Bot. Club. **6**: 207. 1897.

Hypnum (*Brachythecium*) *Donnellii* Aust. Bot. Gaz. **4**: 162. 1879.

Plants small, in thin mats, bright- to yellow-green; stems slender with short irregular branches; stem leaves loosely imbricate, ± 1.5 mm. long, ovate-lanceolate, gradually acuminate, entire (rarely slightly serrulate above) not papillose; costa narrow and rather thin except at base, reaching nearly ½ the length of the leaf; margins plane; median leaf cells linear-fusiform, 9–10 μ wide, 4–7: 1; basal cells shorter; quadrate alar cells numerous, 15–25 on the margin, extending to the costa at base; perichaetial leaves small, similar "ecostate." Monoicous; seta slender about 1 cm. long; capsule very small, urn less than 1 mm. long, ovoid, inclined; operculum conic; inner peristome short, cilia often rudimentary. Type locality Pine Island, Charlotte Harbor, Florida; on roots of trees and over shell mounds. Type seen. Collected at type locality, Feb. 1932, by A. J. G. *Pl. 42.*

Except for the small delicate sporophyte this species is so different from the next as hardly to seem congeneric, yet it is so close to *S. leucostegium* (Brid.) Mitt., which ranges from Mexico to the Argentine, that Mrs. Britton thinks the two identical. In so far as data at hand indicate, the author agrees with her.

2. STEREOPHYLLUM WRIGHTII (Sull.) R. & C. Musc. Am. Sept. Exsic. 57. 1892.

Omalia Wrightii Sull. Mosses U. S. 65. 1856.
Hypnum Wrightii Sull. Icon. Musc. 209. *pl. 127.* 1864.
Stereophyllum cubense Mitt. Jour. Linn. Soc. **12**: 544. 1869 (according to R. & C. l. c.)

Plants in very thin loose patches, dark to yellowish green; stems 1–2 cm. long, prostrate, radiculose below, sparingly branched or divided, complanately foliate; leaves not crowded, more or less two ranked, dorsal oblong-lingulate, obtusely acute to rounded and serrulate at apex, somewhat narrowed to the insertion, with margins plane or inflexed on one side, about 1.5–2 mm. long, 0.6–0.9 mm. wide; costa stout,

extending at least ⅔ the length of the leaf; median leaf cells rhombic to oblong-rhombic, more or less plainly papillose with a single papilla, about 8 x 20–30 μ; basal shorter; subquadrate and transversely elongated angular cells numerous, 20–30 on the margin, often extending to the costa, obscure; lateral leaves narrower, unsymmetric, often with few quadrate alar cells on one side; subcircular paraphyllia occasional; perichaetial leaves subclasping, acuminate and serrulate above. Monoicous; seta slender, about 1 cm. long, light brown, becoming reddish when old; capsule light brown, 1.5–2 cm. long including operculum, oblong, nearly erect and symmetric or cernuous and slightly unsymmetric; operculum long-conic to short-rostrate; annulus lacking; peristome with single well-developed cilia; spores in winter. Type locality, San Antonio, Texas.

Illustrations:—Sull. l. c.; *Pl. 39*.

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 269, (Ed. 2) 536; Aust. Musc. Appal. Suppl. 544; Grout, N. Am. Musc. Pl. Suppl. 7 & Musci Perfecti 210.

On bases of trees and decaying wood, Texas, N. Mexico and Florida; not rare in southern Florida. According to Mrs. Britton's notes at the New York Botanical Garden, *S. radiculosum* (Hook.) Mitt. l. c. 542 is a synonym.

In some specimens the papillae are large and conspicuous, in others scarcely apparent or wanting.

Subfamily PLAGIOTHECIEAE.

Distinguished from the *Hypneae* chiefly by the (usually) complanate and often distichous arrangement of the leaves, which, as a rule, are little or not at all secund; paraphyllia lacking and leaf cells smooth except in the subgenus *Taxiphyllum*. Capsules usually curved and cernuous with perfect peristomes. In a few instances the capsules are erect and symmetric and peristomes with cilia rudimentary or lacking.

15. PLAGIOTHECIUM Bry. Eur. fasc. 48. 1851.

Mostly loosely tufted glossy mosses growing on stones and soil, roots of trees and decaying wood; stems prostrate, irregularly branching; stems and branches appearing flattened by reason of the complanate or complanate-distichous leaf arrangement (except *Roeseanum*, *pulchellum*, *striatellum* and *latebricola*). In many cases the complanate arrangement is brought about by twisting the leaves to either side making them unsymmetric; stem and branches often ending in stolons; paraphyllia lacking except as noted above. Stem and branch leaves usually much alike, ovate, ovate-lanceolate or oblong-lanceolate, acuminate, usually little concave; margins plane (with very few exceptions) and entire to strongly serrate; median leaf cells mostly linear-flexuose, differentiated alar cells few or not very different from the other basal cells (except in *striatellum* and *latebricola*); costa lacking or short and double (with occasionally a single fork of the double costa well-developed and reaching ⅓–½ the length of the leaf); capsules oblong-ovoid to cylindric, usually inclined and more or less unsymmetric (except in *latebricola, laetum, piliferum and Muellerianum*). *P. striatellum*, because of squarrose leaves and inflated alar cells, is likely to be sought under *Campylium*. *Hypnum pratense* because of its complanate leaves is often sought here.

The subgenera are raised to generic rank by Fleischer and Brotherus, but the division into genera in Engler and Prantl is so unsatisfactory that it seems better to wait a more logical division before accepting the probably inevitable split.

The leaves described are from the middle of well-developed branches.

Type species *P. denticulatum*.

Key.

1. Leaves strongly decurrent	I. *Euplagiothecium*.
Leaves not decurrent	2.
2. Minute *leaf-like* paraphyllia present in many leaf axils in our species; upper leaf cells sometimes papillose at back	II. *Taxiphyllum*.
Not as above; plants mostly very slender	III. *Isopterygium*.

I. Euplagiothecium.

1. Leaves scarcely or not at all complanate*	2.
Leaves plainly complanate	3.
2. Leaves squarrose-spreading; alar cells hyaline-inflated	*8. striatellum*.
Leaves not squarrose; alar cells not inflated	*5. Roeseanum*.

* *P. piliferum* may be sought here.

3.	Plants very robust, leafy stems 3–4 mm. wide, gray-green; leaves transversely undulate	*9. undulatum.*
	Not as above	4.
4.	Plants dingy or yellowish green; leaves shrinking in drying so as scarcely to overlap	*2. sylvaticum.*
	Plants not as above; leaves scarcely shrinking	5.
5.	Leaves slenderly acuminate; capsules erect and symmetric; peristome usually without cilia	6.
	Not as above; capsules occasionally suberect	8.
6.	Leaves strongly concave, abruptly piliferous	*7. piliferum.*
	Leaves not as above	7.
7.	Plants exceedingly slender, growing in lowland swamps	*6. latebricola.*
	Plants with the habit of slender *denticulatum*, growing in cool, moist crevices in elevated regions	*4. laetum.*
8.	Edges of leaves strongly incurved and clasping the base of the leaf above, Fissidens-fashion; plants of swamps	*3. Ruthei.*
	Leaves not as above, only slightly incurved; plants of all moist regions	*1. denticulatum.*

II. Taxiphyllum.

	Leaves clearly overlapping even when dry; leaf apex rarely bluntish, rather abruptly narrowed to a longer or shorter acumination	*10. deplanatum*
	Leaves scarcely overlapping when moist; leaf apex usually bluntish as in *Eurhynchium hians*	*11. geophilum.*

III. Isopterygium.

1.	Leaves entire; plants very slender	2.
	Leaves serrate to merely serrulate near apex	3.
2.	Leaves complanate; cortical cells conspicuously large and hyaline	*12. Muellerianum.*
	Not as above	*13. pulchellum.*
3.	Leaves serrulate near apex only	4.
	Leaves serrate above; serrulate nearly or quite to base	6.
4.	Leaves subcultriform; capsules unknown; plants of cold mountain regions	*17. subfalcatum.*
	Leaves sometimes somewhat unsymmetric but much less so than in *subfalcatum*	5.
5.	Plants light yellowish-green; costa very faint or lacking; capsules mostly less than 1 mm. long, without neck	*15. micans.*
	Plants darker green; costa evident in most leaves; capsules 1.5 mm. or more in length, with evident neck	*14. elegans.*
6.	Leaves strongly falcate-secund, more or less complanate at base; capsules light-colored, about 3 mm. long; Pacific Coast plants	*18. silesiacum.*
	Leaves complanate, not secund; capsules shorter and darker; range extending across the continent	*16. turfaceum.*

P. Mariannae n.sp. MF II 272 Florida

I. Euplagiothecium

1. Plagiothecium denticulatum (L., Hedw.) Bry. Eur. fasc. 48. *pl. 501.*
Hypnum denticulatum Hedw. Sp. Musc. 237. 1801.

Plants in wide loose *glossy-green* flattened mats, varying greatly in robustness and color, irregularly branching; branches ascending to nearly prostrate, usually pointed in one direction; branch leaves neither distant nor crowded, complanate, somewhat spreading, scarcely shrinking when dried, usually slightly concave and unsymmetric, 1.5–3 mm. long, oblong-ovate, acute to short-acuminate, broadest slightly above the base, somewhat narrowed to the insertion and strongly decurrent, entire except for the occasional occurrence of a few short teeth near apex; lower margins more or less recurved; costa variable, short and double or lacking, again forking with one branch reaching ⅓ the length of the leaf; median leaf cells linear to linear-rhomboidal, *10–15 μ wide, 10–15 : 1, usually full of chlorophyll*, gradually becoming broader and shorter towards the base; *basal cells subrectangular and pellucid; alar hyaline and decurrent.* Monoicous; seta 2.5–4 cm. long; capsule typically 2–3 mm. long including lid, cylindric, with a distinct neck, inclined to

subhorizontal, more or less unsymmetric or curved, often striate when dry and empty; *lid long-conic to short rostrate; annulus large;* peristome perfect; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. *pl. 84;* Jennings, Mosses W. Pa. *pl. 48.*

EXSICCATI:—Drumm. Musc. Am. 164 (in part only); Sull. Musc. Allegh. 51: Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 351, (Ed. 2) 531, 532; Aust. Musc. Appal. 359 & 360; Grout, N. Am. Musc. Pl. 96, 267 & 267a; no. 96 is very near *sylvaticum.*

On stones, humus and rotten wood in moist shaded places. Common in Canada and the Northern U. S. South to Georgia in the mountains, also in Colorado.

This group, including the varieties and subspecies, of *denticulatum* is one of the most difficult to describe and define clearly, as the plants vary in pretty nearly every character with little apparent correlation. It is very difficult to distinguish many of the forms without authentic specimens for comparison. Different authors also describe the forms differently.

Forma *propaguliferum* Ruthe, leaves strongly unsymmetric, very strongly decurrent, bearing linear-clavate 3–4-celled brood bodies at the back of the leaves. Swamps, Long Island, New York and Eastern Massachusetts, probably elsewhere. Apparently all of this group occasionally have these brood bodies.

Var. DONII (Smith) Lindb. Notis. Salsk. Fauna & Fl. Fennica. 1867.

Hypnum Donianum Smith, Fl. Brit. **3:** 1286. 1804.

Hypnum obtusifolium Brid. Sp. Musc. **2:** 93. 1812.

Very glossy; leaves soft, ovate, blunt or rounded at apex, often apiculate, concave. Alpine or subalpine, rare. N. Am. Musc. Pl. 288.

Var. TENELLUM Bry. Eur. l. c. *pl. 502, f.* β 1–7.

Much more slender, soft, shining; leaves oblong-lanceolate, 1.2–15 mm. long. In crevices in wet cliffs and ledges in cool shaded mountain regions. Not rare in New England. Austin's Musc. Appal. 361, issued as *P. denticulatum* var. *pusillum* seems to belong here.

Var. APTYCHUS (Spruce) **n. comb.** Dixon's Jam., Handb. Brit

Plagiothecium curvifolium Schlieph. Limpr. Laubm. **3:** 269. 1897.

Plagiothecium denticulatum subsp. *aptychus* Spruce, Journ. Bot. **1880:** 353. 1880.

Strongly resembling large forms of *P. sylvaticum* in size, color and general appearance, but leaves smooth and shining, not shrunken, with apices usually more or less curved downwards as in *P. deplanatum;* monoicous, capsules usually long cylindric-arcuate and strongly plicate when dry and empty, sometimes shorter and nearly smooth.

Type locality European.

Common on Vancouver Island and the neighboring coast; British Columbia, east to Montana.

A very striking and usually easily recognizable form. The European form is described as "capsules not plicate." Cardot identified N. Am. Musc. Pl. no. 93 as this species and the ripe capsules are smooth, but on another portion of the same collection were capsules that were older and plainly plicate. This western form seems clearly to be a local form of *denticulatum.* Allen, Mosses Cascade Mts. 116 is a fine example of this variety.

* 2. PLAGIOTHECIUM SYLVATICUM (Huds., Brid.) Bry. Eur. fasc. 48, *pl. 503.* 1851.

Hypnum sylvaticum Brid. Musc. Recent. **22:** 53. *pl. 1, f. 5.* 1801.

Subspecies of *P. denticulatum* and intergrading freely. Larger, more yellowish in color; leaves softer, shrinking when dry so that the leaves do not overlap. Dioicous, capsule long-cylindric, usually more or less striate when dry and empty; operculum usually beaked.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 354; Grout, N. Am. Musc. Pl. Suppl. 10 (the larger plant in the specimen), Musci Perfecti, 4.

On wet humus, rocks and wood, in cool, shaded places. Northern U. S. and southern Canada across the continent, north to Alaska, south to Alabama.

Limpricht, Roth, and Moenkemeyer say that the capsules of *sylvaticum* are striate. Limpricht and Roth say that the capsules of *denticulatum* are not striate. Moenkemeyer says that the capsules of *denticulatum* may be striate. Husnot says of both species, capsules smooth or striate. Abbé Boulay says the same. Spruce and Dixon say that a striate capsule is correlated with a monoicous inflorescence.

Inflorescence is not a valid character in delimiting species in the Hypnaceae unless plainly correlated with other characters. Several plants of a tuft have been examined and all found female only to find the next with both archegonia and antheridia. Boulay finds in the same tuft male, female, and bisexual plants. I find both monoicous and dioicous plants with plicate capsules. The characters separating the two species

are exceedingly variable, as are the descriptions of numerous authors, but the herbarium material is fairly consistent. In Europe there is a form referred to this species that has color and shrunken leaves of this species but the leaves are almost equally spreading and erect-imbricate, more generally acuminate. This form culminates in

Var. ORTHOCLADIUM (Bry. Eur.) Schimp. Syn. (Ed. 1) 585. 1860.

Plagiothecium orthocladium Bry. Eur. *pl. 504.*

Aust. Musc. Appal. 366 seems to be this variety or close to it. There is also a darker smaller form with shrunken leaves that may belong rather to *P. denticulatum* but grows in habitats similar to *sylvaticum*, this may for the present be designated as var. *laxum* Mol. Alg. Alp. 97. 1865. This is well represented in the small dark form distributed as a part of N. Am. Musc. Pl. Suppl. 10, although the identification is not certain. As *sylvaticum* seems to be found in cool wet shaded places, it seems probable that the shrinking is due to the laxity of tissues grown under such conditions.

Var. SUCCULENTUM (Wils.) Husn. Musc. Gall. 352. 1893.

Hypnum denticulatum succulentum Wils. Bry. Brit. 407. 1855.

Very robust, probably the largest form of the *denticulatum* group; leaves reaching 3.5 mm. in length, often somewhat unsymmetric, ovate-oblong, gradually acuminate; costa strong, occasionally reaching ½ the length of the leaf; occasionally synoicous.

Specimens labelled "the original of Wilson," comm. Levier, have been carefully compared with part of the type collection of *Plagiothecium fallax* Card. & Thér., Proc. Wash. Acad. Sci. **4**: 336. 1902, from Alaska; this Alaskan moss (Juneau, April 4, 1904, coll. Mehner) is scarcely to be distinguished from Wilson's moss. The author believes *P. fallax* to be an unimportant variation that should be relegated to synonymy.

* 3. PLAGIOTHECIUM RUTHEI Limpr. Laubm. **3**: 271. 1897.

One of the largest of the *denticulatum* group. Leaves complanate, with both sides of each leaf incurved and clasping the base of the leaf above, asymmetric, about 2.5 mm. long; costa ⅓–½ the length of the leaf. Type locality, Baerwalde, N. M., Germany.

N. Am. Musc. Pl. 55 & 55a. The Fissidens habit of the leaves gives the plants when fresh a peculiar and easily recognizable appearance, but there are all degrees of intergradation. The leaves often bear brood bodies. When dried the plants are more difficult of determination. Staten Island and Long Island, New York; Newfane, Vermont; Tallulah Falls, Georgia; Worcester, Mass.; Quebec; Minnesota; Maryland.

* 4. PLAGIOTHECIUM LAETUM Bry. Eur. fasc. 48. *pl. 495.* 1851.

Smaller than typical *P. denticulatum* with about the habit and appearance of *P. denticulatum tenellum* and apparently grading into it; leaves usually shrinking when dried, slenderly acuminate, less strongly decurrent, often with narrowly revolute margins. Monoicous; capsules erect and symmetric or nearly so; segments of inner peristome narrow, cilia lacking.* Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 40.*
EXSICCATI:—Grout, Musci Perfecti 125; Aust. Musc. Appal. 362.
Mountains of New England, New York, Pennsylvania, eastern Canada, and New Mexico, rare. Drumm., Musci Am. 164 (in part), Height of Land, Rocky Mts., is near this, but presence or absence of cilia could not be determined.

* 5. PLAGIOTHECIUM ROESEANUM (Hampe) Bry. Eur. fasc. 48. *pl. 504.* 1851.

Hypnum Roeseanum Hampe mscr.
Hypnum Sullivantiae Schimp. Bry. Eur. l. c. 16; Sull. Mosses U. S. 680. 156. and Icones Musc. *pl. 126.*
Plagiothecium aciculari-pungens C. M. & Kindb. Cat. Can. Pl. **6**: 216. 1892 (co-type seen).

Cespitose, irregularly branching; stems and branches erect to ascending, usually brittle, often nearly julaceous; leaves crowded, erect-imbricate and scarcely or not at all complanate, ovate-oblong, usually shortly and slenderly acuminate; costa various, sometimes strong and long; median leaf cells narrower than usual in the group (again in propaguliferous and poorly developed plants, shorter), elongate, about 15 : 1. Dioicous; capsules usually suberect, smaller than in most forms of *denticulatum*, operculum conic-apiculate to short rostrate.

Type locality European.

With the range of *P. Denticulatum* and even more common.

* Single cilia sometimes present according to Meylan, Rev. Bryol. **38**: 110.

ILLUSTRATIONS:—Bry. Eur. l. c.; Sull. Icones Musc. l. c.; *Pl. 39.*

EXSICCATI:— Sull. & Lesq. Bor. Am. (Ed. 1) 355 in my set is scarcely characteristic; Aust. Musc. Appal. 364 & 365; Grout, N. Am. Musc. Pl. 434, 418, 125, 126; 126a is too close to *denticulatum*, 486 (issued as *P. denticulatum propagulifera*).

Our plants do not seem to be as bright green and glossy as described by European authors.

A form with propagula much like those shown for *denticulatum* in Limpr. Laubm. **3:** 266 has occasionally been collected but the propagula seem to be found in the axils of the leaves. Slender dark to dirty-green forms with distant spreading, shrunken leaves growing on humus in swamps are frequent about New York City, Montreal, and elsewhere. The leaf cells in this form are often shorter, 5–10 : 1. It is probably a habitat form. At times these come near *sylvaticum* var. *laxum* in appearance. A portion of Austin's Musc. Appal. 364 is this form as is N. Am. Musc. Pl. 418. In most cases a few normal stems can be found in the tufts. It is probably f. *flagellaceum* (Warnst.) Moenkem.

Plagiothecium Sandbergii R. & C. Contr. U. S. Nat. Museum **3**[4]: 274. 1895.

From *P. laetum* and other small forms of *P. denticulatum* differs in its broader more shortly acuminate or apiculate more decurrent leaves. Areolation looser, cells much wider, costa longer and more distinct. Monoicous. Capsule erect. (Original description).

Hope, Kootenai Co., Idaho, August, 1892. (No. 1174.)

Cotype seen at N. Y. Botanical Garden.

Capsules not all erect, often much curved. The author regards this as a small but striking form of *P. Roeseanum* with very blunt often almost obtuse leaves and very wide leaf cells.

6. PLAGIOTHECIUM LATEBRICOLA (Wils.) Bry. Eur. fasc. 48, *pl. 494.* 1851.

Leskea latebricola Wils. ms.

Plants in small dense tufts, bright to yellow-green, glossy; *as slender as forms of P. Muellerianum or pulchellum;* stems short, with numerous short branches, 2 cm. long or less; cortical cells appearing as large as in *P. Muellerianum;* leaves more or less complanate, concave, spreading to erect-spreading, often somewhat secund at ends of stem and branches, strongly overlapping at base, ovate-lanceolate, gradually rather slenderly acuminate, 1 mm. long, usually *strongly decurrent, entire* and mostly plane-margined; costa short and faint or lacking; median leaf cells linear-flexuose, about 7 μ wide, 10–15 : 1; basal broader and shorter, short-rectangular to oblong-hexagonal; decurrent alar cells larger, rectangular, clearly defined and hyaline (2–4 along the margin and about the same number in width). Dioicous; seta usually about 1 cm. long; capsules oblong, erect and symmetric, light brown or yellowish, darker with age; urn less then 1 mm. long; operculum conic-apiculate; annulus narrow; *peristome teeth and segments narrow, almost linear; cilia lacking or rudimentary;* spores in late summer or autumn.

Type locality European (English).

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 39.*

EXSICCATI:—Aust. Musc. Appal. 353; Grout, N. Am. Musc. Pl. 25.

On decaying wood, roots of trees and hummocks of fern in lowland swamps. Newfoundland, Nova Scotia, Massachusetts, Ontario, Wisconsin, south to New Jersey; rare in most localities; apparently more frequent along the coast.

(See distinctions under *P. pulchellum.*) Under the microscope this species suggests a minute narrow-leaved form of *P. denticulatum* or *laetum* but the leaves are all entire and with narrower leaf cells. Forma *gemmascens* Ryan & Hagen is a form with numerous cylindrical septate gemmae in leaf axils and attached to leaf apices. *Plagiothecium attenuati-rameum* Kindb. Macoun, Cat. Can. Pl. **6:** 277. 1892, is a form with long slender attenuate branches, 1–15 cm. long and leaves slightly decurrent. Type seen. *Plagiothecium decursivifolium* Kindb. Macoun, Cat. Can. Pl. **6:** 277. 1892, is a form of *latebricola* with narrower leaf cells, about 5–6 μ wide. Type seen.

7. PLAGIOTHECIUM PILIFERUM (Sw.) Bry. Eur. fasc. 48. *pl. 496.* 1851.

Leskea pilifera Sw. Summa Veg. Scand. 41. 1814 (name only). Hartm. Skand. Fl. (Ed. 1) 419. 1820.
Hypnum trichophorum Spruce, Musc. Pyren. exsic. 66. 1847.

Plants bright green or yellowish, in glossy flat interwoven patches; *leafy stems and branches slender, 1–1.5 mm. wide;* stems prostrate, freely but irregularly branching; cuticular cells hyaline, moderately thick-walled; branches suberect to arched; leaves subcomplanate, close, loosely imbricate, 1–1.2 mm. long by half as wide, *broadly oblong-ovate, very concave, abruptly contracted to a slender filiform flexuose acumination of variable length,* narrowed and narrowly decurrent at base; *margin entire and narrowly reflexed* in the body of the leaf; costa short and double or lacking; median leaf cells narrowly linear, about 6 μ wide, averaging 10 : 1; basal shorter and broader, at basal angles a few wider rectangular hyaline cells. Monoicous; seta 10–15 mm. long, bright red; capsules pale brown, about 2 mm. long, oblong to oblong-ovoid, with a distinct tapering neck, suberect and symmetric to inclined and slightly unsymmetric; exothecial walls thin and

sometimes irregularly shriveled when dry and empty; operculum conic; annulus present; *peristome without cilia, segments and teeth pale and slender;* spores in early summer. Type locality near Stockholm.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 40.*
EXSICCATI:—Drumm. Musc. Am. 165 (as *Hypnum denticulatum Donianum*); Grout, N. Am. Musc. Pl. 71; R. & C. Musc. Am. Sept. Exsic. 325.
On bark of trees and moist stones in cool shaded elevated regions. British Columbia, Washington, Oregon, Wyoming and adjacent areas. Dixon notes that hair points of the leaves are sometimes inconspicuous on some of the branch leaves.

8. PLAGIOTHECIUM STRIATELLUM (Brid.) Lindb. Bot. Notis. 144. 1865.

Leskea striatella Brid. Bry. Univ. **2**: 762. 1827.
Plagiothecium Muhlenbeckii Bry. Eur. fasc. 48. *pl. 499.* 1851.
Plagiothecium Fitzgeraldi Ren., Lesq. & James, Manual 370. 1884.*

Plants in dense dark-green mats; stems prostrate, irregularly branching; branches crowded, erect or ascending; *branch leaves crowded, squarrose-spreading,* 1–1.5 mm. long, ovate-lanceolate to ovate-triangular, gradually tapering to a long slender flexuose acumination, narrowed, rounded and decurrent at the insertion; margins plane and serrulate, at least in the upper part; costa short and double and lacking; median leaf cells linear-flexuose, *short for the genus, 6–7 μ wide, 5–10 : 1;* basal shorter and broader, colored and often pitted when old, *at the angles abruptly inflated, hyaline or colored, forming very distinct decurrent auricles.* Monoicous; seta red, 1–2 cm. long; capsules light brown, urn 1.5–2.5 mm. long, oblong-cylindric, inclined and curved with a tapering neck, plainly striate when dry and empty; operculum conic; annulus large; peristome perfect; spores May to June. Type locality, Newfoundland.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. *f. 200.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 353, (Ed. 2) 533; Aust. Musc. Appal. 358; Grout, N. Am. Musc. Pl. 37, 312, Musci Perfecti 57.
Common in wet shaded places on stones, humus and rotten wood. Arctic America, south to N. Carolina.

9. PLAGIOTHECIUM UNDULATUM (L, Hedw.) Bry. Eur. fasc. 48. *pl. 506.*

Hypnum undulatum Hedw. Sp. Musc. 242. 1801.

Plants very robust with a Neckera habit; leafy stems and branches 3.5–4 mm. broad, growing in loose mats, soft whitish green; stems prostrate, reaching 10–15 cm. in length, irregularly branching, the longer branches 5–10 cm. long; stems and branches often attenuate at the ends, densely foliate; cuticular cells rather large and hyaline; leaves *very large, 3–5 mm. long and about ½ as wide, imbricate,* complanate, broadly oblong-ovate, obtusely acute to short-acuminate, occasionally obtuse, *strongly transversely undulate,* dorsal and ventral unsymmetric, often incurved at the apices, little changed in drying, widest near the base and gradually narrowed to the decurrent insertion; margins plane and entire except at the usually irregularly dentate apex; costa short and double, stronger than in most other species of the genus; median leaf cells linear, 8–10 μ wide, 15–20 : 1 (marginal narrower), toward the base gradually becoming much shorter and broader, the rectangular hyaline decurrent cells at the angles little differentiated. Dioicous; seta 4–5 cm. long, red-brown; *capsule long cylindric-arcuate,* cernuous to horizontal, *striate when dry and empty; urn 3–4 mm. long; operculum conic-rostrate,* about 2 mm. long; annulus present; peristome perfect; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 40.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 72; Allen, Mosses Cascade Mts. 117.
On moist soil and rocks in cool shaded places. British Columbia and Northwestern U. S., south to California.

Var. MYURUM Card. & Thér. Univ. Calif. Pub. **2**: 304. 1906.

Differs from the normal form in the subjulaceous branches, scarcely or not complanate; leaves subimbricate, slightly or not at all undulate, concave, often obtuse. Unalaska, Setchell and others.

Plagiothecium bifariellum Kindb. Bull. Torr. Bot. Club **17**: 279. 1890, is a form of *Eurhynchium praelongum.* Type seen. *Plagiothecium brevipungens* Kindb. Macoun, Cat. Can. Pl. **6**: 215 is not a *Plagiothecium* but a *Hygrohypnum,* scarcely to be distinguished from *H. subeugyrium occidentale* Card. & Thér. except by the larger cylindric-arcuate capsules. Type seen.

* A specimen collected in Florida on decayed trunks, Fitzgerald, in herb. Renauld, labeled *Hypnum Fitzgeraldi,* has been loaned by the Farlow Herbarium and carefully studied. It is apparently the type.

II. Subgenus TAXIPHYLLUM Fleisch. Laubm. Java **4**: 1434. 1922.
(As a genus.)

Plants with the habit of moderately robust *Euplagiothecium;* leaves complanate and serrate nearly or quite to the base in our species; leaf cells elongated-rhomboidal to linear, more or less papillose on the back above in part of the species; small leaf-like paraphyllia present in the axils of many of the leaves; capsules ovoid, inclined; operculum rostrate in our species.

10. Plagiothecium deplanatum (Sull.) Grout, M. H. M. 370. 1910.

Rhynchostegium deplanatum Sull. Musc. Allegh. 50. 1846 (Schimp. ms.)
Plagiothecium missourianum R. & C. Ms. (According to a letter from Cardot.)

Plants bright golden green, in rather dense but thin mats; stems prostrate, 2–3 cm. long; branching irregular, branches mostly prostrate; *leaves close* and overlapping, complanate and regularly arranged in two rows so as to give the characteristic appearance of being regularly plaited or braided with apices slightly turned down, concave, little changed in drying or somewhat shrivelled; well-developed stem and branch leaves oblong-lanceolate to ovate, gradually or abruptly narrowed to a slender or stout acumination of varying length, often somewhat unsymmetric, especially at base, 0.5 x 1.5–2 mm., narrowed to the insertion but much less sharply rounded than in the next; leaves of young shoots and basal and apical branch leaves ovate and more shortly acuminate, often broadly acute; margins plane, sharply serrate above, serrulate nearly to base; costa very short, faint and double or lacking, very rarely longer; median leaf cells linear-flexuose, about 7 μ wide, 8–12 : 1; basal shorter and broader; apical shorter in broad pointed leaves; at basal angles a small triangular group of short-rectangular to quadrate cells (3–6 on the margins), more numerous on the longer side of the unsymmetric base. Dioicous; capsule unsymmetric and inclined, contracted under the mouth when dry and empty and somewhat plicate; annulus lacking; peristome perfect; operculum short-rostrate; spores rarely produced. Type from eastern United States.

Illustrations:—Sull. Icon. Musc. *pl. 108;* M. H. M. *f. 199; Pl. 42.*
Exsiccati:—Sull. Musc. Allegh. 50; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 296, (Ed. 2) 438; Aust. Musc. Appal. 344; Grout, N. Am. Musc. Pl. 174; Bartram, Mosses S. Arizona 161; R. & C., Musc. Am. Sept. Exsic. 198.
On moist shaded ground, and stones in shaded places, Nova Scotia to Minnesota, south to N. Carolina, Tennessee, Missouri, and Arizona; Alaska, *fide* Holzinger & Frye, Pub. Puget Sd. Biol. Lab. 3^{68}: 56. 1921.
An exceedingly variable plant as respects leaf form but with a plaited appearance, due to the regular arrangement of the leaves, that is easily recognized in the field, even without a lens. The only plant that looked like it in all the hundreds of *Plagiothecia* examined was a single stunted specimen of *T. geophilum.* In a lot of 25 collections in the author's collection there was not a single capsule. Sullivant's plate does not represent the leaves at all well. It would seem probable that the drawings were made from a slender-leaved form of *geophilum.* But his no. 296 cited above is true *deplanatum.* (See Musc. Allegh. 50, probably the type.)
The sporophyte has not been seen by the author but the description has been adapted from Sullivant with reservations. Bartram's Arizona plant from an altitude of 9000 ft. has abruptly acuminate leaves with much shorter leaf cells in the upper portion. It is apparently a xerophytic form and may be designated as f. *ovatum* **n. f.** From *Plagiothecium turfaceum* this species is distinguished by its plaited appearance, much broader leaves, with some of the leaves much more broadly pointed and with shorter upper cells. *P. elegans* has much more slender leaves, serrulate at apex only.

11. Plagiothecium geophilum (Aust.) Grout, M. H. M. 370. 190.

Rhynchostegium geophilum Aust. Musc. Appal. 345. 1870.
Hypnum depressum James, Proc. Am. Phil. Soc. 1855. (Not of Bruch, Flora **7**: 763. 1824. *nomen nudum.*)

Plants dark green, in wide thin loose mats; stems 5 cm. or more long, with leaves 2.5–3 mm. wide; branching irregularly pinnate; leaves distant, scarcely overlapping, widely spreading, complanate, somewhat distichous, symmetric and little changed in drying, oblong-lanceolate to oblong-ovate, narrowed and rounded to the insertion, not decurrent, gradually and rather evenly narrowed to an acute or subobtuse apex, 1.2–1.8 mm. long; margins plane, sharply serrate above, serrulate to base; median leaf cells linear-flexuose, about 6 μ wide, 8–15: 1; basal and apical shorter, a few short-rectangular, rather thick-walled cells at the basal angles; upper cells more or less papillose dorsally by the projecting angles of cell walls; costa short and double, usually stronger than in most species of subgenus *Isopterygium,* occasionally faint or lacking. Dioicous; seta slender, 1 cm. long or less, dark red-brown; capsules ovoid, unsymmetric and

inclined; urn usually less than 1 mm. in length; annulus present; operculum strongly beaked; spores in spring or summer, rarely produced. Type from New Jersey, Aust. Musc. Appal. 345.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. *pl. 70;* M. H. M. *f. 198.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 437; Aust. l. c.; Grout, N. Am. Musc. Pl. 369, 369a, and 499 (as *P. deplanatum*).
On moist soil or stones in shady ravines, New York to Wisconsin, south to Maryland, Georgia, and New Mexico. Apparently frequent in portions of Ohio and Indiana and rare elsewhere.
The leaves are often much more slender and acuminate at apex than is shown in Sullivant's figures. The apices of the leaves bear a strong resemblance to those of *Eurhynchium hians*. Mr. A. J. Sharp collected a form of this species on moist soil, 5700 ft. elevation, State Line, Mt. Collins, Smoky Mts., Sevier Co., Tenn., May 15, 1932. The plants are the size and appearance of *P. sylvaticum*, yellow-green, growing in thick tufts, complanate; leaves very wrinkled when dry, not decurrent, with no differentiated alar cells, bicostate with one branch often ½ the length of the leaf or longer, entire below, serrate at or near the apex, asymmetrical.

III. Subgenus ISOPTERYGIUM Mitt. Jour. Linn. Soc. **12:** 21. 1869.
(As a genus.)

Plants slender, mostly bright green and glossy; leaves not decurrent, mostly complanate; alar cells little or not at all differentiated.

12. PLAGIOTHECIUM MUELLERIANUM Schimp. Syn. 584. 1860.

Plants *yellow-green*, usually in thin loose mats, occasionally in thicker tufts with ascending branches; stems and branches slender, appearing strongly flattened, with the leaves 1.2–1.8 mm. wide; branching irregular, often tapering into stolons; *cortical cells enlarged and hyaline*, 3–4 times the width of leaf cells; leaves and leaf structure much as in *P. elegans* but rather abruptly acuminate, *entire*, with costa faint or lacking; leaves often turned upwards at the points, making the frond concave. Dioicous; seta 5–10 mm. long, chestnut-colored; capsules oblong-obovoid, symmetric and erect to somewhat inclined, long-necked, urn with neck 0.7–1.2 mm. long, brown, campanulate when dry and empty; annulus present; operculum conic-rostellate, at least ½ the length of the urn; peristome perfect with rather short cilia; spores in autumn, rarely produced. Type locality European, the Tyrol.
On moist soil and rocks in cool ravines, especially in crevices. From Cape Breton, Nova Scotia to Ohio and Minnesota, south in the mountains to North Carolina; not rare but apparently local.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 66;* M. H. M. *f. 194.*
EXSICCATI:—Aust. Musc. Appal. 351; Grout, N. Am. Musc. Pl. 59.

13. PLAGIOTHECIUM PULCHELLUM (Dicks., Hedw.) Bry. Eur. fasc. 48. *pl. 497.* 1851.

Leskea pulchella Hedw. Sp. Musc. *pl. 55. f. 7–12.* 1801.
Plagiothecium pseudo-latebricola Kindb.; Macoun, Cat. Can. Pl. **6:** 211. 1892. Type seen.

Plants in rather dense bright-green patches or cushions, often intertangled with other mosses; *the most slender of all the Isopterygia* except forms of *Muellerianum;* stems short, prostrate, sending up numerous short (± 1 cm. long) suberect or curved branches like the pile of a coarse velvet; branch leaves rather close, erect-spreading, scarcely complanate, often somewhat secund at stem and branch tips, lanceolate to narrowly ovate-lanceolate; gradually narrowed from the widest part at the base to a very slender, moderately long acumination, slightly narrowed and rounded to the insertion, scarcely changed in drying, less than 1 mm. long; margins plane and entire; median leaf cells narrowly linear-flexuose, ± 6 μ wide, 15–20 : 1; basal shorter, *alar scarcely different. Monoicous;* seta about 1 cm. long, brown to red-brown; capsules brown, oblong-cylindric to ovoid, with operculum 1.5–2 mm. long, suberect and nearly symmetric to somewhat curved and inclined, somewhat contracted under the mouth when dry and empty; operculum conic-apiculate; annulus large; peristome perfect; spores in early summer. Type from Scotland?

ILLUSTRATIONS:—Br. & Sch. l. c.; M. H. M. *f. 197.*
EXSICCATI:—Drumm. Musc. Am. 67; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 530; Aust. Musc. Appal. 354 & 352 (as *P. passaicense* Aust.); Grout, N. Am. Musc. Pl. 144.
On decayed wood mainly, also on stones and roots of trees in cool shaded areas. Arctic America, south to New England, Pennsylvania, Michigan, Colorado, Wyoming, Montana, and Washington. Rare, but frequent in parts of British Columbia.

Var. NITIDULUM (Wahlenb.) Husnot, Musc. Gall. 354. 1894.

Hypnum nitidulum Wahlenb. Flor. Lapp. 370. 1812, excluding synonyms.
Plagiothecium nitidulum Bry. Eur. *pl. 498*.

Plants more robust; stems often stoloniferous at the ends; tufts thinner and straggling; branches spreading to nearly prostrate, more plainly complanate; leaves with a longer and more slender acumination; leaf margins sometimes slightly denticulate above. Forms occur with a very few differentiated alar cells.

With the species, apparently a habitat form; frequent in Rocky Mountain region. Allen, Mosses Cascade Mts. 146.

Slender forms of *P. Muellerianum* are distinguished at once by the large thin-walled cortical cells and *P. latebricola* by its strongly decurrent leaves.

Bartram has collected a moss (no. 600) in the Patagonia Mts. of Arizona that seems to belong to this species; the leaf cells are a trifle wider, 7–8 μ, and there is an occasional projecting cell along the upper leaf margin so that the leaves are not strictly entire.

14. PLAGIOTHECIUM ELEGANS (Hook.) Sull. Mosses U. S. 80. 1856.

Hypnum elegans Hook. Musc. Exot. **1**: *pl. 9*. 1818.
Hypnum planifolium Brid. Bryol. Univ. **2**: 411. 1827.

Plants in rather closely interwoven patches, dark to bright green, glossy, small and delicate; stems prostrate, 2–3 cm. long, irregularly branching; branches slender, usually less than 1 cm. long, procumbent or ascending, usually pointing in one direction, sometimes flagellate at the ends, with leaves about 2–2.5 mm. wide; cortical cells small and thick-walled; normal stem and branch leaves complanate and appearing two-ranked, not crowded, spreading, and equally and regularly arranged on each side of the stem, little changed in drying, often bearing in the axils gemmiform branchlets with minute leaves, symmetric, occasionally slightly secund, especially at stem and branch tips, oblong-lanceolate to ovate-lanceolate, averaging about 1.5 mm. long x 0.35 mm. wide, gradually narrowed from about the middle, then in most cases more abruptly narrowed above to a fine rather short acumination, somewhat concave, rounded at base to a rather narrow non-decurrent insertion; margins plane, entire except at the acumination, which is more or less serrulate in most leaves; costa usually evident, double, with one branch longer and sometimes reaching ⅓ the length of the leaf; median leaf cells narrowly linear-flexuose, 4–7 x 70–100 μ; basal row or two shorter, alar scarcely different. Dioicous; seta 12–20 mm. long, red-brown; capsules ovoid to oblong-ovoid, nearly symmetric but inclined or pendent due to a curve at the top of the seta, contracted under the mouth when dry and neck often somewhat wrinkled; urn about 1.5 mm. long; operculum conic-apiculate, obtuse; annulus well developed, of one or two rows of large deciduous cells; peristome perfect; spores in early spring, rarely produced.

Type from the Pacific coast of N. America, Menzies.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. *pl. 64;* M. H. M. *f. 195;* Limpricht, Laubm. **3**. *f. 396* (gemmiform branchlets).

EXSICCATI:—Aust. Musc. Appal. 348; Allen, Mosses Cascade Mts. 145; Grout, N. Am. Musc. Pl. 143.

In moist shaded crevices of ledges of non-calcareous rock and on humus in similar situations, northern U. S. and Canada, across the continent, south to Long Island and New Jersey, and in the mountains to North Carolina and Tennessee, and in the west to California. Frequent in suitable locations.

As the type was from the Pacific slope, the description is based on N. Am. Musc. Pl. 143 from Seattle. Variation in leaf shape and size is great. Foster collected a very robust form as large as Var. *Schimperi* (no. 441) at Cathlamet, Washington, that has the slenderly acuminate leaves somewhat secund, with the points turned down. From about the steam vents near the summit of Mt. Ranier, comes a slender, light-colored form, approaching var. *gracilens* in size and leaf form, but not complanate, though the characteristic gemmiform branchlets are abundant. When present these branchlets, different from the gemmae of any other species, serve for recognition; when sterile it may be distinguished from *P. micans* by its darker color, less contorted leaves having an apparent costa, and by the longer leaf cells, usually a little narrower; also it rarely fruits, while *P. micans* is a free and abundant producer of fruit; from *P. turfaceum* it is distinguished by leaves serrulate at apex only; slender forms of the *P. denticulatum* group are sometimes referred to *elegans* but are readily distinguished by the larger leaf cells.

Var. SCHIMPERI (Jur. & Milde) Limpr. Kryptfl. Schles. **1**: 83. 1876.

Plagiothecium Schimperi Jur. & Milde in Rabenh. Bryoth. Eur. 588. 1861.

Seems to be essentially the robust form, with bright green leaves, 1.2–1.4 mm. long and 0.45–0.6 mm. wide. It is described as having the leaves broader and more shortly acuminate, often slightly falcate

above; gemmae apparently rare. Sullivant, Icon. Musc. Suppl. 86 refers to this variety as Lindberg's var. *terrestre* and cites Austin's Musc. Appal. 349. But this last seems to be merely a robust form with little difference except size.

Var. GRACILENS Aust. Musc. Appal. 350. 1870.

A very slender form, leafy branches about 1.5 mm. wide, leaves ovate to broadly oblong-ovate, short-acuminate, 0.7–0.9 mm. long, sharply serrate above in the type (Aust. Musc. Appal 350), much smaller than this in other specimens; leaf cells shorter, mostly under 60 μ in length.

This variety is so different that Austin suggested a new species, but some of the collections have the gemmiform branchlets characteristic of the species. A form collected under an overhanging cliff on a cold north slope at Newfane, Vt., has narrower leaves than usual and approaches the more slender, narrower-leaved European var. *nanum* (Jur.) Walth. & Mol. Such forms and probably most var. *gracilens* are developed under unfavorable light conditions. This variety seems to have about the range of the species. Occasionally it is found in thick velvety cushions in crevices in ledges.

15. PLAGIOTHECIUM MICANS (Sw.) Paris, Index Bryol. (Ed. 1) 963. 1897.

Hypnum micans Sw. Muhlenb. Cat. 104. 1829 and Ann. Bot. 175. 1829.
Hypnum albulum C. Muell. Syn. Musc. **2**: 280. 1851.
Hypnum subsimplex Sull. Musc. Allegh. no. 52, 1856. (According to C. Mueller.)
Hypnum tenerum Hook. & Wils. in Drumm. Musc. Am. S. States 108 & 109.

Plants in thin loose mats, usually *light yellow-green*, rarely darker, small; stems prostrate, slender, 2–4 cm. long, with leaves 1.5–2 cm. wide, irregularly branching, branches also prostrate, both rather firmly attached to substratum by numerous bunches of radicles; bunches of filaments often present in leaf axils; stem leaves thin, usually rather distant, more or less complanate, erect-spreading, occasionally somewhat secund, ovate-lanceolate, more or less contorted when dry, 0.75–1.2 mm. long, gradually long-acuminate, serrulate above, ecostate; branch leaves more shortly and more abruptly acuminate, the dorsal twisted and usually curved to one side, making them very unsymmetric, with the upper margin concave-incurved, more strongly serrate than the ventral, which are often entire; median leaf cells linear-flexuose, 6–8 μ wide, 9–13 : 1; basal shorter and broader, at insertion usually a row of noticeably shorter and broader cells extending across the base, these are sometimes lacking and often fail to be removed with the leaf; above these at the basal angles is a very small and variable group of subquadrate cells, in some specimens an inflated cell or two at angles, (well illustrated in Sullivant's plate); cortical stem cells fully as wide as median leaf cells; perichaetial leaves variable, the inner gradually long-acuminate or abruptly narrowed to a slender linear acumination, in either case serrulate above, in the latter case bordered at the narrowing with elongated cells and often coarsely dentate, both kinds of perichaetial leaves found on the same plant and even in the same perichaetium. Monoicous; seta slender, 1–1.7 cm. long, orange to reddish-brown; capsules small, urn without neck usually less than 1 mm. long, ovoid to short-oblong, light brown, dark when old, more or less contracted under the mouth when dry and empty, unsymmetric and cernuous; annulus lacking; operculum conic-apiculate to very short-rostrate, at least ¾ the length of the urn; peristome perfect with two cilia, usually shorter than the segments; spores in early winter. Type locality, southern United States?

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 112;* M. H. M. 367, *f. 196.*
EXSICCATI:—Drumm. l. c.; Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 302; Aust. Musc. Appal. 427 & 429; Grout, N. Am. Musc. Pl. 225; 214 & 274 as var. *fulvum.*

On rotten wood and soil at base of trees, from Long Island and New Jersey south to the Gulf of Mexico, especially near the coast, abundant in the southern states, west to Missouri. Immensely variable; the extreme variations are described in the varieties described below but all kinds of intermediate forms occur.

Through all its variations a few characteristics seem constant, the light color, the lack of costa, the cell structure of the leaf, and the small capsules on a comparatively long and slender, light-colored seta. The species fruits almost as freely as *P. striatellum.*

Var. FULVUM (Hook. & Wils.) Paris, l. c.

Hypnum fulvum Hook. & Wils. in Drumm. l. c. 110.

The largest form, stems and branches longer, wider, and more complanate, approaching in size and appearance small forms of *P. denticulatum* but lighter-colored or more brownish when old; leafy stems reaching 3 mm. in width in the type; leaves 1.2–1.7 mm. long, gradually and slenderly acuminate in the type and strongly serrate above. Capsules more than 1 mm. in length. Type duplicate seen. Usually

found in swamps and bogs. Probably further collections will indicate that this is at least a subspecies. Plants that seem to belong to this variety often have nearly entire leaves and in other cases the leaves are less slenderly acuminate. The bunches of short filaments in the leaf axils seems to be more conspicuous in the variety. Southern States, frequent.

Forma LATIFOLIUM Grout, **n. comb.**

P. micans var. *latifolia* Grout, N. Am. Musc. Pl. 408. 1922.

A robust form usually as large as the variety *fulvum*; leaves oblong-ovate, acute rather than acuminate, sometimes almost obtuse. Georgia, Florida.

Var. MINUS **n. var.**

Very small and slender, leafy stems and branches about 0.6 mm. wide; stem leaves ± 0.5 mm. long; perichaetial leaves abruptly acuminate, sometimes scarcely serrulate; urn about 0.6 mm. long; seta usually less than 1 cm. long. Type from rotten log, Orange City, Florida, Grout, April, 1911. Type in herb. A. J. G. Also collected in Thomasville, Georgia by Mrs. Taylor, on soil and roots of trees.

Var. GROUTII (Card. & Thér.) Grout, **n. comb.**

Plagiothecium Groutii Card. & Thér. Bot. Gaz. **37**: 379. *pl. 24. f. 3.* 1904.

A slender form a little larger than var. *minus* and more slender than typical *micans;* branch leaves and many of the stem leaves ovate to broadly ovate-lanceolate, 0.7–0.9 mm. long, abruptly narrowed to a short serrate acumination; dorsal leaves strongly unsymmetric, curved sidewise (subcultriform); beak as long as rest of operculum when dry; cilia well developed, often nearly as long as segments; perichaetial leaves mostly abruptly acuminate, slightly or not at all serrate as a rule. Spores in late autumn. Type from depression in base of old chestnut tree, Hempstead, New York, Dec. 1, 1899. Type in Cardot Herb. in Muséum d'Histoire Naturelle, Paris; cotype in herb. A. J. G.

ILLUSTRATIONS:—Card. & Thér. l. c.; *Pl. 37.*
Grout, N. Am. Musc. Pl. 196 is a type duplicate; Sull. & Lesq. Musc. Bor. Am. 302b closely approaches this variety as does Aust. Musc. Appal. 429. Dr. John K. Small collected a similar form from "Hammocks south of Coot Bay, Monroe Co., Florida, April 1, 1916, no. 7521." Oneco, Florida, Grout. All the collections except the type have few leaves as abruptly short-acuminate as the type. Contrary to the original description, most capsules of the type collection are contracted under the mouth when dry.

16. PLAGIOTHECIUM TURFACEUM (Lindb.) Lindb. Oefvers. Vet.-Akad. Förh. **14**: 124. 1857.

Hypnum turfaceum Lindb. Fl. Dan. Suppl. fasc. **2**: 17. 1857.
Hypnum pseudo-silesiacum Hook. & Wils. in Drumm. Musc. Am. S. States, 111. 1841.*
Plagiothecium sulcatum Card. & Thér. Bot. Gaz. **37**: 378. 1904.

Plants bright green, sometimes yellowish, growing in rather thin loose mats; stems prostrate, 2–4 cm. long, closely attached to substratum, irregularly branching; leafy stems 2.5–3 mm. wide; cortical cells thin-walled and somewhat wider than the median leaf cells; leaves ovate-lanceolate to oblong-lanceolate, long-acuminate, narrowed to the insertion, complanately spreading by the turning to the sides of the upper and lower leaves, occasionally somewhat secund with points turned down, about 1.5 mm. long, or less, *sharply serrate above, serrulate nearly or quite to the base with distant teeth,* costa short and faint or lacking, when present mostly single; median leaf cells linear-fusiform, about 6 μ wide and 10–12 : 1; basal somewhat shorter; alar scarcely different or a few more short cells than elsewhere at the base, occasionally a single inflated cell at extreme basal angle; perichaetial leaves ovate, abruptly acuminate, sharply serrate above; monoicous; seta 12–18 mm. long, light to red-brown, capsules oblong to oblong-cylindric, usually curved and inclined; urn 2 mm. long or a little less, wrinkled at the neck when dry, *when dry and empty usually more or less plicate throughout;* annulus large; operculum conic; peristome perfect; spores in summer. Type from Sweden.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. *pl. 65;* M. H. M. *pl. 83.*
EXSICCATI:—Aust. Musc. Appal. 356; Grout, N. Am. Musc. Pl. 89 & 384, Musci Perfecti 61. Specimens of *P. sulcatum* Card. & Thér. of the type collection have been seen through the courtesy of Prof. Rosendahl of the Univ. of Minnesota.

* Cotype seen.

On decaying wood and humus in cool shaded moist places. Southern Canada and northern U. S., west to Ontario and Minnesota. According to Jennings "south to Georgia and Texas," but rare south of Pennsylvania and New Jersey. Apparently frequent in New England. It is found in Manitoba, British Columbia, and Northwest Territory according to Macoun. *P. turfaceum* has very much the appearance of large forms of *P. elegans* but its much more strongly serrate leaves will distinguish sterile forms. It fruits frequently and its capsules are inclined but never pendent. These are additional points of distinction. Occasionally the leaves are scarcely complanate, and these forms are puzzling.

17. Plagiothecium subfalcatum Aust. Musc. Appal. 366. 1870, and Sull. Icon. Musc. Suppl. 90. *pl. 67.* 1874.

Plants in rather thin intertangled, bright-green patches, resembling in gross appearance forms of *P. elegans* or small *denticulatum;* distinguished from the former by the rather broader, less slenderly acuminate leaves, *which are also strongly unsymmetric and curved backwards, almost cultriform,* lower margin often slightly recurved, leaf cells also slightly wider than in *elegans* and narrower than in *denticulatum.* Sporophyte unknown.

Crevices of rocks in the mountains of New Jersey, New York, Pennsylvania, New Hampshire, and Vermont, also near Foley, Lincoln Co., Missouri.

The relationships of this species are doubtful. It may be a derivative of *P. elegans.* Its non-decurrent leaves distinguish it from all forms of *denticulatum,* as will the much serrate leaf apices. Sullivant's excellent figures are the best means of determining this species. *Pl. 43.*

18. Plagiothecium Seligeri (Brid.) Lindb. in Th. Fries, Bot. Not. 144. 1865.

Leskea Seligeri Brid. Musc. Rec. 2^2: 47. 1801.
Plagiothecium silesiacum (Seliger) Bry. Eur. fasc. 48. *pl. 500.* 1851.
Hypnum silesiacum Seliger in P. B. Prodromus 70, 1805.
Plagiothecium repens Lindb. Notis. Sällsk. Fauna & Fl. Fennica 9: 36. 1867.

Plants comparatively robust, in loose pale-green tufts; stems creeping, irregularly branching; branches 15–20 mm. long, arched and often attenuate at the tips; leaves somewhat complanate, *irregularly and widely spreading, especially when moist, falcate-secund,* 1.5–2 mm. long, ± 0.6 mm. wide, oblong-lanceolate to ovate-lanceolate, *gradually narrowed to a long slender and flexuose acumination,* sharply serrate above, serrulate below, narrowed and somewhat rounded to the insertion; margins plane; costa short and double, faint; median leaf cells linear-flexuose, ± 6 μ wide, 10–15 : 1; basal shorter and broader, incrassate, more or less pitted and colored; a few angular subquadrate to rectangular on the margin, at the insertion often appear 1 or 2 hyaline thin-walled cells ± 20 μ wide and below these are often detached large rectangular cortical cells about 15 μ wide; perichaetial leaves ovate to oblong, rather abruptly acuminate, more closely serrate than the others. Monoicous; seta light red, 15–20 mm. long; capsule *long arcuate-cylindric,* cernuous, with lid 3 mm. long, having a noticeable neck, scarcely contracted under the mouth when dry and empty, usually smooth and unwrinkled when dry and empty but with notable exceptions even in European plants; operculum conic-obtuse; peristome perfect; annulus present, of one or two rows of cells; spores in summer. Type locality European.

Illustrations:—Bry. Eur. l. c.; *Pl. 42A, Pl. 43A.*
Exsiccati:—Allen, Mosses Cascade Mts. 115.

In both European and American specimens the capsules are often somewhat wrinkled if immature. Most European specimens have an annulus of a single row of cells but there are exceptions. Also the leaves are broader and more sharply serrate than shown in the Bry. Eur. figures. Some American students have confused *deplanatum* with *Seligeri,* but the leaf arrangement is strikingly different and the leaves of the former are relatively much wider.

On decaying wood and humus in cool elevated regions; rare in N. America. Washington, Allen; Columbia Falls, Montana, Williams; Vancouver, Id., Macoun; Edgewood, B. C., MacFadden.

Subfamily ENTODONTEAE.

Primary stems creeping; paraphyllia lacking; leaves not papillose, often plicate or concave, ecostate; median leaf cells linear, alar quadrate (except *Holmgrenia*). Seta smooth; operculum conic to short-rostrate; capsule erect and symmetric, not conspicuously contracted under the mouth when dry and empty; peristome mostly with narrow linear segments, attached to a narrow basal membrane; cilia rudimentary or wanting; teeth often without the fine cross lines on the lower sections.

Homalothecium, *Chamberlainia* and some species of *Plagiothecium* have the capsule characteristics of this subfamily, but in the two first the leaves are costate to the middle or beyond. The *Plagiothecia* have for the most part to be distinguished by their individual gametophyte characters.

KEY.

Quadrate alar cells numerous	*1. Entodon.*
Quadrate alar cells lacking	*2. Holmgrenia.*

1. ENTODON C. Muell. Linnaea, **18**: 704. 1844.

Cylindrothecium Bry. Eur. fasc. 46–47. *pl. 464, 465*. 1851.

Plants in wide intricate mats. Stems densely leafy, creeping, subpinnately branching (stems erect and pinnately branching in *E. orthocarpus*); stems and branches more or less complanate-foliate; leaves many-ranked, imbricate, entire or slightly toothed at apex; costa short and double or lacking; leaf cells linear, enlarged and quadrate at the basal angles. Monoicous (except *E. orthocarpus*); seta long and smooth; capsules cylindric, erect and symmetric (rarely slightly curved); annulus large and conspicuous (except in *E. Drummondii*); peristome inserted below the mouth of the capsule; otherwise as described for the subfamily.

Type species *E. Schleicheri* (Bry. Eur.) Broth.

KEY.

1. Leaves obtuse; quadrate alar cells in two or three layers	*7. orthocarpus.*
Leaves acute or acuminate; quadrate alar cells in one layer	2.
2. Leaves gradually and narrowly acuminate; segments adhering to the teeth	*6. brevisetus.*
Leaves acute to apiculate; segments free	3.
3. Seta yellow; annulus apparently lacking	*5. Drummondii.*
Seta red; annulus present	4.
4. Leaves scarcely or not at all complanate	*2. seductrix.*
Leaves strongly complanate	5.
5. Plants robust; leafy stems and branches more than 1 mm. wide; peristome teeth not strongly striolate or papillose	*1. cladorrhizans.*
Plants slender; leafy stems and branches 1 mm. wide or less; peristome teeth striolate or papillose	6.
6. Leaves mostly serrulate at apex; teeth striolate above	*4. Sullivantii.*
Leaves mainly entire; teeth uniformly papillose-roughened	*3. compressus.*

1. ENTODON CLADORRHIZANS (Hedw.) C. Muell. Linnaea, **18**: 707. 1844.

Neckera cladorrhizans Hedw. Sp. Musc. 207. *pl. 47*. 1801.
Entodon transylvanicus Demet. Hedwigia, **23**: 81. 1884.
Entodon minutipes Kindb. Can. Rec. Sci. **1894**: 21. 1894.

Plants in wide soft glossy yellow-green intricate mats; stems about 5 cm. long, subpinnately branching; stems and short branches strongly complanate-foliate, lying in the same plane; branch leaves oblong-ovate, gradually narrowed to the insertion, about 1.5 x 0.6–0.8 mm., acute, with apex often slightly reflexed, entire or slightly denticulate at apex, very concave; margins plane or narrowly recurved below; median leaf cells linear-fusiform, 6 μ wide, 10–15 : 1; apical shorter, quadrate alar numerous (8–10 on the margin); stem leaves larger and broader at base, more abruptly acute; inner perichaetial leaves oblong-acuminate, denticulate at extreme apex. Seta 1.5–2 cm. long, light reddish-brown; capsule cylindric-ovoid, brown, up to 3.5 mm. long including operculum; annulus large; operculum conic-apiculate to short-rostrate; peristome .35–.4 mm. long, closely and regularly articulate and slightly granulose-roughened below, more distantly articulate and smooth or nearly so above, with a conspicuous median line, often perforate between the articulations; segments linear, as long as the teeth; spores in autumn. Type locality, Lancaster, Pa. (Muhlenberg).

On roots of trees, old logs and less frequently on soil in moist woods. Frequent in North America east of the Great Plains, less frequent in the Southern States, not yet reported from Florida; Minnesota, Iowa, New Mexico.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 91;* M. H. M. *f. 204a–d & 206.*

EXSICCATI:—Drumm. Musc. Am. S. States 96 (as Neckera); Sull. Musc. Allegh. 77; Sull. & Lesq. Musc. Bor. Am (Ed. 1) 260, (Ed. 2) 386; Macoun, Can. Musc. 263; Aust. Musc. Appal. 284; Grout, N. Am. Musc. Pl. 309, Musci Perfecti 165.

E. acicularis C. M. & Kindb. Macoun, Cat. Can. Pl. **6:** 176 is only a peculiar form of *E. cladorrhizans.* It has a peculiar brownish-green color, tips of branches lighter; branches short and turgid, larger in the middle and bearing there leaves as large as those on the stem; capsule and seta much shorter and teeth more perforate than is typical.

In the canyon at Tallulah Falls, Georgia, apparently in moist or muddy soil, Dr. John K. Small collected a form of this species with some of the stems stoloniferous and bearing rather narrowly lanceolate leaves, serrulate at the slender apex (no. 9331, April 1893).

2. ENTODON SEDUCTRIX (Hedw.) C. Muell. Linnaea, **19:** 214. 1847.

Neckera seductrix Hedw. Sp. Musc. 208. *pl. 47, f. 8–13.* 1801.
Pterigynandrum carolinianum Brid. Musc. Recent. Suppl. **1:** 132. 1803.

Plants in wide glossy yellow-green mats; stems about 5 cm. long, subpinnately branching; *branches julaceous,* 5–25 mm. long; branch leaves *imbricate-appressed,* oblong-elliptical to ovate, narrowed to the insertion, ± 1.2 x 0.7 mm., short-apiculate, with apiculation often reflexed, very concave; margins plane or slightly reflexed at base, entire or slightly serrulate at apex; costa short and double; median leaf cells linear, 6 μ wide, 8–12 : 1; *quadrate alar cells numerous (10–20 on the margin) sometimes extending for ¼ the length of the leaf;* stem leaves larger, ovate, with rather broader cells; inner perichaetial leaves oblong-acuminate, serrulate at apex, somewhat plicate, with a thin costa. Seta about 1.5 cm. long, red-brown; capsule red-brown, *3–3.5 mm. long, 5–6 : 1, cylindric, erect and symmetric;* operculum conic-rostrate; *annulus rather indefinite, of 2 to 3 rows of small cells,* obscured by the base of the teeth and little differentiated; peristome teeth subulate, short, 0.3 mm. long, very deeply inserted; *teeth with a very distinct median line, articulations close and irregular below but distant above, only 7–10 appearing above the mouth of the capsule; segments linear, about the length of the teeth;* spores autumn to winter. Type locality, Lancaster, Pennsylvania (Muhlenberg).

An exceedingly variable species and appropriately named.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. *pl. 92;* M. H. M. *f. 204 & 205.*

EXSICCATI:—Drumm. Musc. Am. S. States 97 (as *Neckera*); Sull. Musc. Allegh. 78; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 261, (Ed. 2) 387; Aust. Musc. Appal. 282, 283; Macoun, Can. Musc. 663; R. & C. Musc. Am. Sept. Exsic. 90; Grout, N. Am. Musc. Pl. 51, 173, 374.

On decaying wood, bases of trees, moist soil and stones, often in rather dry situations. Common from Ontario to the Gulf of Mexico, and from southern New England to southern Florida; west to Minnesota, Kansas and Texas.

Var. LANCEOLATUS Grout, Bull. Torr. Bot. Club **23:** 226. 1896.

Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering gradually to a serrate acute apex; median leaf cells 12 : 1; capsule about 8 : 1. On rotten wood, Hanging Rock, Wabash Co., Illinois, April 3, 1890. J. Schneck. This closely resembles *E. polysetus* C. Muell. from Brazil, which has even more slenderly pointed leaves and striolate teeth.

Var. MINOR (Aust.) Grout, l. c.

Entire plant much reduced, dirty green; leaves, seta and capsule shorter than in the type; capsules 1.5–2 mm. long, about 3 : 1. Type from Ohio (Sullivant). Also from Pennsylvania and Georgia. A portion of Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 388 in the Columbia Univ. Herbarium, issued as *Cylindrothecium compressum* is this variety.

Var. DEMETRII (R. & C.) Grout, l. c.

Cylindrothecium Demetrii R. & C. Rev. Bryol. **20:** 14. 1893.

Stems irregularly divided and branched, strongly complanate-foliate, having almost exactly the appearance of *E. compressus;* leaves ovate, gradually acute, very entire in the type, often serrulate in other specimens. Capsule small, about 2 mm. long; peristome teeth often irregularly perforate. Type from stones at top of well, Emma, Saline Co., Missouri (Demetrio). Washington Co., N. Y. (Burnham).

In contrast to most Hypnaceae the most characteristic structure of this species is its peristome.

Judging from the figures, Hedwig's type of this species differs considerably from the plant figured by Sullivant; it has ovate leaves and rather short capsules. Sullivant figures an elliptical-oblong leaf and a much longer capsule. The plants corresponding to Hedwig's figures grow in places that are rather dry at times and its leaves are regularly and closely imbricated on the stout terete branches.

The plants corresponding to Sullivant's figures grow on rotten wood in more moist situations; the branches are more slender, the leaves less abruptly apiculate and less closely and regularly imbricate. Sullivant's figure of the mouth of the capsule shows it as it appears when first mounted but when cleared with glycerine 2 or 3 of the upper rows of cells show up as small annulus cells.

Var. TENUIS Grout, N. Am. Musc. Pl. 186. 1904.

Plants dark glossy green; stems and branches very slender; stems tapering into slender stolons; leaves ovate-lanceolate and slenderly acuminate as in var. *lanceolatus* but entire.

Queen's Bluff, Winona Co., Minnesota (Holzinger).

3. ENTODON COMPRESSUS (Hedw.) C. Muell. l. c. 707.

Leskea compressa Hedw. Sp. Musc. 232. *pl. 56, f. 1–7.* 1801.

Plants in thin dirty green mats, sometimes glossy yellow-green; stems and branches complanate-foliate and lying in the same plane, as in *E. cladorrhizans* but much more slender, leafy stems about 1 mm. wide; stems often much divided, subpinnately branching; leaves becoming appressed in drying, causing the plants to lose their complanate appearance to some extent; branch leaves oblong-ovate, ± 1.1 mm. long, 2 : 1, very concave, obtuse, with apiculation short or none, with few exceptions quite entire; costa short and double or lacking; median leaf cells linear, about 5 μ wide, 8–12 : 1; basal cells much broader and shorter; alar cells quadrate (8–10 on the margin), extending almost to middle of leaf base; stem leaves larger, proportionally broader; perichaetial leaves long-sheathing, the inner oblong-lanceolate, very gradually acuminate, entire. Seta 0.7–1.5 mm. long; capsule brown, *elliptic to ovoid*, narrowed toward the mouth, 2.5 x 0.6 mm.; operculum conic-rostrate, with a slender inclined beak; annulus large, persistent; peristome 0.3–0.4 mm. long, teeth narrowly linear-lanceolate, *closely and regularly articulate, densely and minutely papillose;* segments linear, shorter than the teeth, minutely papillose; spores maturing in autumn. Type locality, Lancaster, Pennsylvania (Muhlenberg).

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. *pl. 93;* M. H. M. *f. 207.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 264, (Ed. 2) 388 (mixed with *E. seductrix minor*).

On soil and rotting logs in the shade, also roots of trees near water. Rhode Island, New Jersey, Ohio, Illinois, Kansas, Nebraska, S. Dakota, Missouri; not common.

Easily distinguished when fruiting by its short capsules and long regularly articulate, papillose teeth.

4. ENTODON SULLIVANTII (C. Muell.) Lindb. Contrib. ad Fl. Crypt. As. Bor. Or. 233. 1872.

Neckera Sullivantii C. Muell. Syn. Musc. **2**: 65. 1851.

Plants in rather thin glossy-green mats; stems 3–5 cm. long, irregularly divided, subpinnately branching; stems and branches slender, with leaves 1–1.5 mm. wide, narrower in xerophytic forms; branches 5–15 mm. long; branch leaves ovate-lanceolate, ± 1.1 x 0.4 mm., *acute and serrate at apex,* very concave, margins incurved; median leaf cells linear, 6 μ wide, ± 8 : 1; quadrate alar cells numerous, 8–10 on the margin and extending nearly or quite to costa at the insertion; costa short and double, strong for the genus; stem leaves much larger, 1.6 mm. long, broadly ovate-lanceolate, entire except at apex; inner perichaetial leaves oblong-ovate, long-acuminate, entire or serrulate at apex. Seta 1.5-2.5 cm. long, orange; capsule brown, cylindric, erect and symmetric, larger near base, with operculum 3.5–4 mm. long, 5–7 : 1; operculum conic-rostrate; annulus very large; peristome nearly 0.4 mm. long, with teeth linear-lanceolate, orange, closely and regularly articulate, articulations more distant above *and sections marked with irregular striolae which are vertical to oblique,* lower sections obscurely and horizontally striolate; segments a little shorter than the teeth, linear from a slightly wider base; spores in autumn. Type locality in woods along the French Broad River, N. Carolina (Sullivant).

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 95; Pl. 43E.*

EXSICCATI:—Sull. Musc. Allegh. (as Leskea); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 263, (Ed. 2) 389; Grout, N. Am. Musc. Pl. 304.

On damp rocks in woods. N. Carolina, Tennessee, S. Carolina; Stone Mt., Georgia. Very rare. Also reported from Japan.

Resembling *E. compressus* but distinguished by its more slender stems and branches, serrate leaves, longer capsule and striolate peristome teeth.

5. Entodon Drummondii (Bry. Eur.) Jaeger & Sauerb. St. Gall. Nat. Gesell. **1876–77**: 282.

Cylindrothecium Drummondii Bry. Eur. fasc. 46–47. 1851.
Neckera cladorrhizans Hook. & Wils. in Drumm. Musc. Am. S. States 96. 1841.

Plants in rather thin yellow-green mats; stems 4–8 cm. long, subpinnately branching; stems and branches complanate-foliate, lying in one plane; branches short, *with leaves ± 2 mm. wide;* branch leaves loosely imbricate, oblong-lanceolate to ovate-lanceolate, 1.8 x 0.5–0.7 mm., acute, *serrate at apex*, concave, nearly or quite ecostate; median cells linear-flexuose, 7 μ wide, 15 : 1, basal cells shorter and broader, rectangular to rhomboidal, quadrate alar cells 4–6 on the margin, extending nearly to middle of leaf base; stem leaves shorter and broader with more numerous enlarged and hyaline basal cells; inner perichaetial leaves oblong, long-acuminate with a few long spreading teeth at the apex. Seta 10–25 mm. long, *bright yellow;* capsule brown, erect and symmetric, cylindric, with operculum 2–2.5 mm. long, 4 : 1; operculum long-conic to short-rostrate; mouth of capsule bordered by two or three rows of horizontally compressed cells and above these a row of enlarged cells without cavity, simulating annulus cells; peristome about 0.25 mm. long; teeth linear-lanceolate, smooth and hyaline above, striolate and often thicker, brown, and perforate below; segments linear, nearly or quite as long as the teeth; spores apparently maturing in spring. Type locality, Louisiana (Drummond).

Illustrations:—Sull. Icon. Musc. *pl. 94; Pl. 43D.*
Exsiccati:—Drumm. Musc. Am. S. States 96 (type); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 264, (Ed. 2) 390; Aust. Musc. Appal. Suppl. 558; R. & C. Musc. Am. Sept. Exsic. 91; Grout, N. Am. Musc. Pl. 245. Macoun's Can. Musc. 436 is not this species.
On rocks base of trees and logs in moist woods; southern U. S. east of the Mississippi, north to Tennessee and N. Carolina; also in northern Mexico.
Distinguished at sight by the very wide flattened branches and yellow seta.

6. Entodon brevisetus (Hook. & Wils.) Jaeger & Sauerb. l. c. 291.

Neckera breviseta Hook. & Wils. Lond. Jour. Bot. **4**: 489. *pl. 24, f. a.* 1842.

Plants in wide densely intricate mats, dark green below, young growth lighter; stems varying greatly in length, averaging about 5 cm., creeping, subpinnately branching; branches short, suberect, abruptly tapering at the end; leaves closely imbricate when dry; branch leaves *lanceolate, 1.9 x 0.6 mm., gradually and narrowly long-acuminate, entire* or slightly serrulate at apex, concave, narrowed to the insertion; *costa double, extending nearly ¼ the length of the leaf;* median leaf cells linear-fusiform to oblong-hexagonal, ± 7 μ wide, 6 : 1; basal cells rectangular, alar quadrate (extending up the margin in a narrow band ± ¼ the length of the leaf) chlorophyllose; stem leaves larger, ovate-lanceolate; inner perichaetial leaves oblong-lanceolate, long-acuminate, entire. Seta 1–2 cm. long, light reddish brown; capsule brown, 2.5–3 mm. long, 5 : 1, ovoid-cylindric, contracted below the mouth when dry and empty; operculum long-conic, obtuse; annulus large; peristome teeth linear-lanceolate, reddish brown, closely and regularly articulate, bordered the entire length by the adherent segments as in *Pylaisi Selwynii;* spores in autumn. Type locality near St. Louis, Missouri (Drummond).

Illustrations:—Hook. & Wils. l. c.; Sull. Icon. Musc. *pl. 96; Pl. 43B.*
Exsiccati:—Drumm. Musc. Am. S. States 95 (the type); Sull. Musc. Allegh. 79; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 265, (Ed. 2) 391; Grout, N. Am. Musc. Pl. 184, 303; Aust. Musc. Appal. 285.
On base of trees, limestone rocks and soil, apparently more or less calcicolous. New Brunswick, New Jersey, Pennsylvania, Virginia, Ohio, Missouri; rare.
This species is readily distinguished from all our others by its narrowly acuminate leaves and adherent segments of the inner peristome. The archegonia and antheridia seem to have a tendency to appear in alternate seasons on the same plants.
On the bark of trees in the mountains of North Carolina there are forms with long slender stoloniferous stems, bearing very narrow slender leaves that are most unlike the normal forms.

7. Entodon orthocarpus (La Pyl.) Lindb. Musc. Scand. 39. 1879.

Hypnum orthocarpum La Pylaie in Brid. Bryol. Univ. **2**: 422. 1827.
Cylindrothecium Montagnei Bry. Eur. fasc. 46–47. *pl. 465.* 1851.
Cylindrothecium concinnum Schimp. Syn. 515. 1860.

Plants in wide loosely intricate yellowish-green tufts; stems 2–10 cm. or more long, suberect, pinnately branching; stems and branches terete to somewhat complanate-foliate, rigid; branches about 1 cm. long, tapering; branch leaves oval-oblong, 1.2 x 0.6 mm., obtuse, entire, very concave, with involute margins above, ecostate or shortly bicostate; median leaf cells linear-flexuose, about 7 μ wide, 10–15 : 1, growing broader and shorter toward the apex; basal shorter and broader, rectangular, incrassate and pitted; at basal angles quadrate (10–15 on the margin) thin-walled and in two or three layers; stem leaves larger and relatively broader, with median cells longer and narrower. Dioicous; sporophyte not yet found in N. America; seta 1.5–2 cm. long; capsule brown, erect, cylindric, symmetric, 3 mm. long, 5 : 1; operculum conic-rostrate, with beak often oblique; annulus present, of 2–3 rows of small cells; peristome teeth linear-lanceolate, red-brown and closely articulate above, often perforate or split along the median line; segments linear, as long as the teeth; spores in autumn. Type locality, France.

Illustrations:—Bry. Eur. l. c.; Husnot, Musc. Gall. *pl. 89; Pl. 41.*
Very rare; Newfoundland, Colorado, New Mexico.
Resembling *Calliergon Schreberi* in appearance but the stems are not red and the basal and angular cells are less distinct and not hyaline or orange and the alar cells are in more than one layer. Whenever present the capsules are very distinctive.

2. HOLMGRENIA Lindb. Oefv. Vet.-Ak. Förh. **19**: 605. 1863.

Orthothecium Bry. Eur. fasc. 48. 1851. Not Schott & Endl. Melet. Bot. 31. 1832.

Plants in wide glossy bright-colored mats (or scattered among other mosses); primary stems irregularly divided, sparsely branching; paraphyllia lacking; leaves erect, not decurrent, usually entire, or sometimes slightly serrulate, acuminate, concave; costa short and double or lacking; median leaf cells linear, basal shorter and broader, alar little differentiated. Sporophyte rare; seta long and smooth, calyptra small fugacious; capsule nearly or quite erect and symmetric; operculum conic; annulus large; peristome double, teeth and segments lanceolate, the latter from a broad basal membrane; cilia single, usually short or lacking.

Key.

1.	Plants large; stems 5–10 cm. long; leaves strongly plicate	*1. chrysea.*
	Plants small; stems 2–4 cm. long; leaves not plicate	2.
2.	Leaves ovate- to ovate-lanceolate	3.
	Leaves narrowly lanceolate	*2. intricata.*
3.	Leaf margins strongly revolute; peristome without cilia	*3. stricta.*
	Leaf margins plane	4.
4.	Leaves broadly ovate, abruptly short-acuminate to apiculate; sporophyte unknown.	*5. acuminata.*
	Leaves ovate to ovate-lanceolate, gradually acute to acuminate; peristome with single cilia	*4. diminutiva.*

1. Holmgrenia chrysea (Schwaegr.) Lindb. l. c.

Hypnum chryseum Schwaegr.; Schultes, Reise auf d. Glockner **2**: 364. 1804.

Plants in thick glossy golden tufts; stems 5–10 cm. long, erect to ascending, simple or sparingly divided; leaves imbricate, not complanate or secund, ovate-lanceolate to triangular-ovate, 1.3–2 x 0.4–0.8 mm. (Limpricht says 2.5–3.3 long), apiculate to short-acuminate, concave, strongly plicate, nearly or quite ecostate; margins entire, recurved; median leaf cells linear, 6 μ wide, 12–14 : 1; basal somewhat shorter and broader, thick-walled and golden brown; perichaetial leaves triangular-ovate, the inner long-acuminate, sharply toothed above, not plicate. Dioicous; seta golden-brown, 2–3 cm. long; capsule ovoid-cylindric, often slightly unsymmetric, contracted under the mouth when dry and empty; operculum conic; annulus of 2 rows of cells; peristome perfect, with rather short cilia; spores spring to early summer. Type locality European.

Illustrations:—Bry. Eur. *pl. 461; Pl. 41.*
Exsiccati:—N. Am. Musc. Pl. Suppl. 18.
On moist rocks and stony slopes, in alpine or boreal regions. Rare and seldom fruiting. Rocky Mts., Saskatchewan, Montana, Colorado.

2. Holmgrenia intricata (Hartm.) Lindb. l. c.

Leskea intricata Hartm. Skand. Fl. (Ed. 5) 336. 1849.

Plants in wide densely intricate mats, of various shades of green, dark, brownish, yellowish or reddish; stems filiform, 2–4 cm. long, creeping, somewhat stoloniferous, irregularly divided; branches short and erect or elongated and prostrate; leaves equally appressed-imbricate to somewhat secund, narrowly lanceolate, 0.8–2.5 x 0.2–0.45 mm., subulate to long filiform-acuminate, *entire*, somewhat concave, *not plicate*, ecostate *with plane margins;* median leaf-cells linear, 6 μ wide, 8–10 : 1; basal cells shorter and broader, often colored a red-brown; alar not differentiated; inner perichaetial leaves lanceolate, long filiform-acuminate. Dioicous; seta 1.5–2 cm. long; capsule erect and symmetric, red-brown, oblong-ovoid, about 2 mm. long; operculum conic; annulus present; peristome teeth closely and regularly articulate; segments from a narrow basal membrane, linear, perforate, longer than the teeth; cilia lacking. Type locality European.

Illustrations:—Bry. Eur. *pl. 462; Pl. 41.*

On rocks around Kicking Horse Lake, Rocky Mts. (Macoun), near New Denver, British Columbia, (MacFadden); Owen Sound, Ontario (Moxley).

Both European and American plants vary greatly in size and in the length of leaf acumination. The high alpine form known as var. *sericea* (Bry. Eur.) is much more slender with smaller leaves represented fairly well in *figure 8* of the Bry. Eur. illustration in *Pl. 41.* Mrs. MacFadden's plant is close to this variety.

The margins on some of the leaves of undoubted *intricata* are sometimes more or less revolute in both European and American plants. This inclines the author to the belief that Husnot is right in calling the next a variety of *intricata*, even though Limpricht considers it more closely allied to *H. chrysea.*

3. Holmgrenia stricta Lorentz, Moosstud. 122. *pl. 5.* 1864.

Stereodon rubellus Mitt. Jour. Linn. Soc. **8**: 40. 1865.

Plants small, cespitose, orange, glossy; secondary stems erect to ascending, sparingly branched; lower branch leaves elongated ovate, upper erect-imbricate, ovate-lanceolate, 1 x 0.3–0.4 mm., *not plicate or sulcate*, ending in a short flexuose subhyaline acumination; *margins revolute, serrulate above;* costa short and double; median leaf cells oblong-linear, ± 8 μ wide, 6–8 : 1; basal cells shorter, brownish yellow, alar not strongly differentiated; stem leaves larger, 1–1.4 mm. long with shorter acumination. Dioicous; perichaetial leaves ovate-lanceolate. Sporophyte lacking. Type locality, the Alps. *Pl. 41.*

Davis Strait (Taylor, a ship's surgeon, not Dr. T. Taylor whose herbarium is at Harvard). Rocky Mountains (Macoun).

Mitten says of his *Stereodon rubellus:* "A small moss with the habit, appearance and color of *Orthothecium intricatum* Br. & Sch. but differing in its almost exactly ovate leaves, with a short sometimes discolored apiculus, the margin revolute, and the areolation composed of cells which are twice as wide."

The author has seen Mitten's type. The leaves are as described, while the European form is described as having ovate-lanceolate leaves. Husnot's fig. 10 in the illustration of *H. intricata* shown in *Pl. 41* as illustrating its var. *binervulum* represents the outline of the leaf in Mitten's plant fairly well. The figures 7–9 represent Husnot's idea of *H. stricta.*

4. Holmgrenia diminutiva **n. sp.**

Plantae pertenues; caulis paululum ramosus, circa 1–2 cm. longus; folia circa 0.6 mm. longa, erecto-patentia, quandoque secunda, ovata, sensim brevi-acuminata vel acuta, concava. Capsula erecta, oblongo-cylindrica, peristomio perfecto. A *H. intricata* distinguitur, foliis brevioribus, brevius acuminatis, peristomii ciliolis singulis.

Somewhat resembling depauperate *H. intricata;* stems very slender, ascending, a little branched, 1–2 cm. long; cortical cells large and thin-walled; leaves close, erect-spreading, somewhat secund, ovate to ovate-lanceolate, narrowed and rounded to the insertion, *gradually acute to acuminate*, concave, nearly or quite entire, ecostate or nearly so, about 0.6 mm. long; median leaf cells linear-flexuose, about 5–6 μ, 8–12 : 1; basal shorter, alar little differentiated; perichaetial leaves longer, *more abruptly short-acuminate.* Seta slender, 1.5–2 cm. long; capsule nearly erect and symmetric, oblong to cylindric, urn about 1.5 mm. long; *peristome perfect hypnaceous with well-developed single cilia;* base of teeth marked with fine transverse lines.

Type from Tolland, Colorado, July, 1913. Type in herb. A. J. G. and cotype in herb. Dixon.

In a mixed tuft of *Pohlia*, and *Drepanocladus uncinatus* var. on the bank of a creek about 7000 ft. elevation.

Mr. Dixon thinks the leaf characters not inconsistent with a variety of *H. intricata* but the shorter and much less slenderly acuminate leaves considered in connection with the well-developed single cilia in the peristome seem to the author to indicate a specific difference.

5. Holmgrenia acuminata (Bryhn) **n. comb.**

Orthothecium acuminatum Bryhn, Bryophyta in Itinere Polari Norvagorum secundum Collecta, Kristiana, 1906.

Plants exceedingly slender (leafy stems about 0.5 mm. wide), golden-green above, brownish below; stems julaceous, reaching 3–4 cm. in length, sparingly divided, often giving off slender stoloniferous branches bearing minute leaves, leaves closely appressed-imbricate, round-ovate to oblong-ovate, abruptly very short-acuminate, 0.6–0.8 mm. long, slightly serrulate above; median leaf cells oblong to oblong-rhombic, about 9 x 35–45 μ; basal shorter, incrassate and deeply colored, obscure, alar scarcely differentiated.

Sporophyte unknown. Type from King Oscar Land, July, 1901, 76° 40′ (H. G. Simmons, no. 3228) again collected 76° 30′, June, 1901 (no. 2786). Also at Ellesmere Land, Bedford Pine Island, July, 1899 (no. 1183). These specimens collected on the voyage of the Fram were communicated by Dr. Johannes Lid of the Botanical Museum at Oslo.

Family LESKEACEAE.

Mosses of varying habit and size, growing on shaded earth, stones, trunks of trees or decayed wood, usually lusterless; main stems creeping with ascending or erect secondary stems. In *Thuidium* the stems are regularly pinnately branched and ascending, having somewhat the appearance of miniature ferns; central strand rudimentary or lacking in most cases. Stem leaves often very different from the branch leaves, both strongly costate in most species; costa not excurrent; leaf cells rarely more than 3 : 1, often less, mostly papillose, papillae often large; leaf cells of the basal portion of the leaf more elongated and less strongly papillose, often smooth. Paraphyllia present in most species, often abundant, varying in form but mostly slender and branched. Seta long and smooth (except *T. involvens*). Capsules erect and symmetric in most of our species except in the *Thuidieae*. The *Thuidieae* also have the perfect hypnaceous peristome, but most of the other species illustrate well the degeneracy of the peristome in erect capsules as explained in M. H. M. p. 28; in these the cilia are usually vestigial or lacking and the segments often very narrow, or, in some cases, imperfect.

The text in the treatment of this family is largely based on the excellent monographs of the principal genera published several years ago in the Bulletin of the Torrey Botanical Club by the late Dr. George N. Best.

(A key to the genera of the entire family will be given at the end of this family.)

Subfamily THUIDIEAE.

Stems rather stiff; branching irregular to regularly pinnate and complanate; capsules inclined, unsymmetric; peristomes perfect with well-developed cilia and horizontal striae on the external basal plates of the peristome teeth.

Key to Genera.

1. Costa poorly developed, short and thin or lacking ..... *4. Heterocladium.*
   Costa well developed, often percurrent ..... 2.
2. Paraphyllia scale-like or wanting ..... *3. Claopodium.*
   Paraphyllia filamentous, usually abundant ..... 3.
3. Apical cells of branch leaves with 1–4 papillae; stem leaves without paraphyllose filaments at base ..... *1. Thuidium.*
   Apical cells of branch leaves without papillae; stem leaves with paraphyllia-like filaments at base ..... *2. Helodium.*

1. THUIDIUM Bry. Eur. fasc. 49–51. 1852.

Plants slender to robust, mostly stiff, in greenish, yellowish or brownish cushions; stems creeping, ascending or erect, pinnately branched, often regularly and in one plane; branches simple, pinnate or bipinnate; stem and branches more or less thickly covered slender simple or branched paraphyllia; stem leaves often quite different from the branch leaves, ovate-triangular to oblong-lanceolate, acuminate,

cordate, plicate, strongly costate, papillose on one or both surfaces; branch leaves smaller, ovate to ovate-lanceolate; both stem and branch leaves erect-spreading to open-erect when moist, when dry incurved or appressed but never secund. Capsules oblong-cylindric, unsymmetric, suberect to pendulous; annulus large; peristome perfect, with well-developed cilia and a broad basal membrane fully ⅓ the length of the teeth; operculum from short-conic to long-rostrate. Type species *T. tamariscinum* (Hedw.) Bry. Eur.

KEY.

1.	Apical cell of branch leaves crowned with 2–4 papillae	2.
	Apical cells of branch leaves with a single terminal papilla	10.
2.	Paraphyllia numerous, more or less branched	3.
	Paraphyllia few, small, mostly linear-oblong, 2–6 cells long	8.
3.	Stems closely once pinnate, branches subjulaceous when dry	4.
	Stems loosely pinnate; branches pinnate to bipinnate	5.
4.	Plants comparatively soft; leaf cells with 2–5 small papillae on each surface	*5. scitum.*
	Plants rigid; leaf cells with a single papilla on each surface	*6. abietinum.*
5.	Stem leaves spreading-recurved, margins plane, costa percurrent; perichaetial leaves not ciliate; apparently calcicolous	*4. recognitum.*
	Stem leaves erect-spreading, margins recurved, costa vanishing below apex	6.
6.	Stem leaves usually with a hyaline filiform acumination	*2. Philiberti.*
	Stem leaves acute to acuminate, not hyaline at apex	7.
7.	Perichaetial leaves ciliate; plants very regularly bi- tri-pinnate	*1. delicatulum.*
	Plants less regularly bipinnate; perichaetial leaves not ciliate	*3. Alleni.*
8.	Subtropical only; seta rough throughout	*7. involvens.*
	Found from Canada southwards; seta smooth	9.
9.	Plants very small, 1–2 cm.; stem and branches filiform, branches papillose	*9. pygmaeum.*
	Plants small, 2–4 cm.; branches smooth	*8. minutulum.* (schistocal
10.	Stem leaves roundish-ovate, abruptly acuminate to a broad oblong point; margins erose-serrate	*11. virginianum.*
	Stems leaves rather gradually long-acuminate; margins crenulate-serrate or entire.	*10. microphyllum.*

1. THUIDIUM DELICATULUM (L., Hedw.) Mitt. Jour. Linn. Soc. **12**: 578. 1869.

Hypnum delicatulum Hedw. Sp. Musc. 260. 1801.

Plants large, in intricate spreading mats, bright green or yellowish above, darker below; stems 5–10 cm. long, ascending, often arched; branching *regularly twice or three times* pinnate; paraphyllia very numerous, multiform; *stem leaves appressed when dry, erect-spreading when moist,* sulcate, triangular-ovate, subcordate at base, rather gradually acuminate, about 1 mm. long; *costa gradually becoming thinner and vanishing in the apex;* margins papillate-serrate, recurved; leaf cells unipapillate on both sides, occasionally bipapillate, rather thick-walled, oblong-quadrate to oval-rhombic, 7–8 μ wide, 1–3 : 1; branch leaves smaller, ovate, acuminate, the apical cells with 2–4 papillae; inner perichaetial leaves more or less ciliate on the margins, the loricate-filiform serrate acumination about twice as long as the blade. Dioicous; seta 2–3 cm. long, stiff, chestnut in color; capsule cylindric-arcuate, inclined to horizontal; annulus large; operculum conic-rostrate; spores late autumn to winter. Type localities, "Pennsylvania, Maryland and Virginia."

On soil, rotten wood and stones in moist shaded places. Common from Labrador to British Columbia, southward in the U. S. to the Gulf, rare or lacking on the Pacific coast.

ILLUSTRATIONS:—M. H. M. *f. 128, f. 122b* and *pl. 52, f. 7;* Grout, Mosses with H-lens *pl. 51 & 52;* Jennings, Mosses of Western Pa. *pl. 36.*

EXSICCATI:—Drumm. Musc. Bor. Am. 213, S. States, 136; Sull. Musc. Allegh. 3 (as *Hypnum tamariscinum*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 272, (Ed. 2) 403; Aust. Musc. Appal. 302; Grout, N. Am. Musc. Pl. 76, 76a, 300.

*2. THUIDIUM PHILIBERTI Limpr. Laubm. **2**: 835. 1895.

Thuidium intermedium Philib. Rev. Bryol. **20**: 33. 1893. Not of Mitten, Jour. Bot. & Kew Misc. **3**: 353. 1851; and Jour. Linn. Soc. **12**: 573. 1869.

A poorly delimited subspecies of *T. delicatulum;* stem leaves usually *with a hyaline filiform acumination, composed of a single row of 3–8* linear cells; perichaetial leaves looser, more spreading and flexuose, slender

acumination nearly three times as long as the body of the leaf in the inner leaves, rarely with a few short cilia; annulus narrow or indistinct. Type locality, France.

ILLUSTRATIONS:—Bull. Torr. Bot. Club **23**: *pl. 260; Pl. 44.*

In wet swampy places, on the ground or at the base of small trees. New Jersey (Best); Pennsylvania (Porter); New Mexico (Holzinger).

3. THUIDIUM ALLENI Aust. Bull. Torr. Bot. Club **7**: 16. 1880.

Thuidium glaucinum (Mitt.) Borch. & Lac. var. *ludovicianum* Card. Bryol. **8**: 51. 1905.

Plants in rather thick loose wide mats; stems erect to ascending, bipinnately branching but much less regularly so than in *T. delicatulum*, densely paraphyllose; stem leaves rather distant, incurved when dry, spreading when moist, broadly ovate, shortly and broadly acuminate, acute or obtuse, rarely more slenderly acuminate, concave, with recurved margins ("bisulcate"), narrowed and rounded to the insertion; margins crenulate-papillose, otherwise entire; costa strong, ending below the apex; median leaf cells oblong to rounded-quadrate, thick-walled, about 7 μ wide, 1–2 : 1, *each with one or more comparatively low papillae on each face;* basal cells somewhat longer; paraphyllia few or none on branches and branchlets; *branch leaves broadly ovate, not acuminate, acute to obtuse*, very concave, with plane margins, leaves of branchlets similar but smaller; *perichaetial leaves not ciliate.* Mature sporophytes unknown. *Pl. 42.* N. Am. Musc. Pl. 398 and Suppl. 9.

Dr. Best in a letter dated May 13, 1906, accepts *T. Alleni* as a good species and states that he has it from Pennsylvania, Virginia, S. Carolina and Georgia. He also stated that Cardot's plant from Louisiana is the same thing and on one of these plants he found the non-ciliate perichaetial leaves. He further stated that *T. Alleni* "while resembling *T. glaucinum*, differs in several respects, more especially in the papillae, which in the latter are spinulose."

The type from Connecticut seems to represent the northern range of the species. In it the stem leaves seem to be less incurved than in the Florida plants, but Austin in his original description says "*foliis siccis crispatis.*" This is well shown in *Pl. 42, f. 5.*

T. Alleni is abundant in certain localities in Florida and is easily distinguished in the field from *T. delicatulum* (which is also frequent) by its less regular branching and more scraggly appearance. Under the microscope the low papillae are very distinctive. The stem leaves are occasionally as long-acuminate as in most *T. delicatulum.*

4. THUIDIUM RECOGNITUM (Hedw.) Lindb. Not. Sallsk. pro Fauna et Flora Fenn. **13**: 416. 1874.

Hypnum recognitum Hedw. Sp. Musc. 261. 1801.
Hypnum protensum Mx. Fl. Bor. Am. **2**: 317. 1803.
Thuidium delicatulum Bry. Eur. fasc. 49–51. *pl. 484.* 1852 (not of Linn.).

Very close to *T. delicatulum* and confused with it by many authors and students. Distinguished as follows: rarely if ever tripinnate; branches more uniform in length, making the ends of the fronds oblong, leaves rather more crowded at the ends of the stems, *spreading-recurved* when dry, broadly triangular, more abruptly acuminate; margins usually plane; *costa percurrent, strong and thick, often even to the very tip of the leaf;* perichaetial leaves with the narrow acumination about as long as the body of the leaf, not ciliate; capsule as a rule more narrowly cylindrical. Type locality, Saxony. Type in the Boissier Herbarium at Geneva.

ILLUSTRATIONS:—Bry. Eur. l. c.; Jennings, l. c.; M. H. M. *f. 127 & pl. 52, f. 8.*

EXSICCATI:—Drumm. Musc. Am. 214; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 273 (as *Hypnum delicatulum*), (Ed. 2) 404; Aust. Musc. Appal. 303; Grout, N. Am. Musc. leaf. 77.

On soil, rotten wood and stones in moist shaded woods in limestone regions. Labrador to British Columbia, southeast to Florida? Much less frequent than *delicatulum*, rare or absent on the Pacific slope.

On one of the perichaetial leaves of Musc. Bor. Am. 273, which is otherwise characteristic *recognitum*, I found a much branched structure, more like paraphyllia than cilia.

5. THUIDIUM SCITUM (P. B.) Aust. Musc. Appal. 51. 1870.

Hypnum scitum P. B. Prod. 69. 1805. Broth. as Kauia scita

Plants in thin appressed mats, green to yellow-brown below; stems 4–6 cm. long, prostrate, simple or divided, *densely pinnately branched;* branches 2–3 mm. long, simple, terete when dry; paraphyllia multiform, mostly linear; stem leaves broadly *cordate-deltoid*, 0.5–0.6 mm. long, long and narrowly acuminate, bisulcate; margins plane, finely papillose-denticulate; costa broad, pellucid, vanishing in the base of the acumination; median leaf cells rounded-hexagonal, 6 μ in diameter, incrassate, obscure, *pluripapillate* (*3–6*); middle basal oblong; branch leaves smaller, broadly ovate-acuminate; inner perichaetial leaves erect long filiform-

acuminate. Monoicous; seta about 1.5 cm. long; capsule oblong-cylindric, straight or slightly curved, erect or inclined; annulus large; operculum conic-rostrate; peristome perfect; spores in autumn or early winter. Type locality North American. Type in the Delessert Herbarium, Geneva.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 99;* Jennings, Mosses W. Pennsylvania *pl. 35; Pl. 44.*
EXSICCATI:—Sull. Musc. Allegh. 6; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 276, (Ed. 2) 409; Aust. Musc. Appal. 300; Grout, N. Am. Musc. Pl. 135.
On roots and bases of trees, more rarely on soil or stones; Ontario to Wisconsin and Missouri, eastward to the Atlantic Ocean and south to N. Carolina and Georgia.

Var. AESTIVALE Aust. Musc. Appal. 301. 1870. Stems more diffusely divided, less densely pinnate; perichaetial leaves more abruptly filiform-acuminate; *capsule curved, horizontal, wide-mouthed;* operculum more abruptly rostrate with shorter beak; spores in summer. With the range of the species in the main.

6. THUIDIUM ABIETINUM (L., Brid.) Bry. Eur. fasc. 49–51. *pl. 485.* 1852.*

Hypnum abietinum Brid. Musc. Rec. 2^2: 80. 1801.

Plants about the size of *delicatulum*, yellowish green at the tops, darker and brownish below, growing in dense tufts or mats; stems 5–10 cm. long, ascending-erect, stiff, closely and regularly pinnately branched; branches simple, unequal, slender, attenuate, terete when dry; paraphyllia multiform, mostly linear; stem leaves crowded, broadly ovate, acuminate, 0.9–1.2 mm. long, deeply biplicate; margins papillate-serrulate; costa strong, reaching ¾ the length of the leaf or beyond; median leaf cells oval-rhombic, unipapillate, reaching 10 μ wide; quadrate-hexagonal and smaller at the basal angles; branch leaves similar but smaller, apical cell usually with two papillae, sometimes only one; inner perichaetial leaves slender, gradually attenuate, plicate, without cilia. Dioicous; seta 1.5–3 cm. long; capsule narrowly cylindrical, suberect, curved, with an evident neck; operculum long-conic, acute; annulus large; peristome perfect; spores in spring, infrequently produced. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 37.*
EXSICCATI:—Drumm. Musc. Am. 216; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 280; Aust. Musc. Appal. 394; Grout, N. Am. Musc. Pl. 43.
On rocks, stones and soil in dry sterile places, often among grass and herbage. Greenland to Virginia, west to British Columbia and Alaska. Fruiting in Montana, Colorado and Alaska, sterile elsewhere.
Dixon states that the branches are in two rows in two planes but that is not evident in the plants studied.

7. THUIDIUM INVOLVENS (Hedw.) Mitt. Jour. Linn. Soc. **12**: 575. 1869.

Leskea involvens Hedw. Stirp. Crypt. **4**: 37. *pl. 11.* 1797; and Sp. Musc. 218. 1801.

(The synonymy given by Paris in the second edition of the Index Bryologicus is not quoted here because of its somewhat doubtful character.)

Plants relatively small and slender for the genus, growing in thin loose dark-green mats; stems 2–4 cm. long, creeping, pinnately branched, branches 2–5 mm. long; paraphyllia few, apparently found on the stems only, linear; leaves erect-spreading, curved inward and almost crisped when dry; stem leaves ovate-lanceolate, slenderly acuminate, reaching 0.6 mm. in length, entire, with costa reaching to base of acumination; branch leaves subdistichous, unsymmetric, the lower oblong-ovate and acute, often a little larger than the stem leaves, the upper oblong and almost rounded at the apex, somewhat concave with the lower margin more or less reflexed; costa nearer the lower margin, ending well below the apex; leaf cells papillose, each with several small papillae, irregularly quadrate to subhexagonal, about 10 μ in diameter, little different at base of leaf; inner perichaetial leaves long filiform-acuminate from an ovate base, acumination appearing subserrulate by projecting cell walls, costa percurrent. Seta 10–15 mm. long, dark red, strongly and closely papillose; capsule ovoid, unsymmetric, inclined to drooping, urn about 1.2 mm. long, operculum rostrate, about ⅔ the length of the urn; annulus present; peristome perfect; spores in autumn. Type locality, Jamaica, W. I.

ILLUSTRATIONS:—Hedw. l. c.; *Pl. 42.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 483 is mostly *Mittenothamnium diminutivum* (Hampe.) E. G. B. Some specimens contain *T. minutulum* and others a little *T. involvens.*
On logs and bases of trees; Florida from Sanford southwards, apparently rare.

*See Best in Bryologist **8**: 17. 1905.

8. THUIDIUM MINUTULUM (Hedw.) Bry. Eur. fasc. 49–51. *pl. 481.* 1852.

Hypnum minutulum Hedw. Stirp. Crypt. **4**: 90. *pl. 34.* 1797; Sp. Musc. 260. 1801.

Plants small but *a little larger than T. pygmaeum*, in thin dark green mats; stems 2–4 cm. long, creeping, pinnately branched, stems and *branches smooth*, bearing a few simple linear paraphyllia, 3–6 cells long; stem leaves distant, triangular-ovate, acuminate to apiculate, 0.6–0.8 mm. long; margins papillose-crenulate, somewhat revolute below; costa strong, ending near the apex; leaf cells irregularly polygonal to quadrate-hexagonal, about 9 μ in diameter, marginal larger, all thick-walled and pluripapillose; branch leaves ovate-acuminate, about 0.2–0.3 mm. long, concave with a shorter costa; perichaetial leaves erect, slenderly long-acuminate, entire. Monoicous; seta 2–2.5 cm. long, slender; capsule yellowish, about 3 mm. long including operculum, oblong-ovoid, unsymmetric, inclined to horizontal, rough; operculum rostrate; peristome perfect, cilia usually 2; annulus large; spores in autumn. Type locality, Lancaster, Pennsylvania, Muhlenberg.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. l. c.; Jennings, Mosses W. Pa. *pl. 35;* M. H. M. *pl. 52 & f. 123; Pl. 37.*

EXSICCATI:—Drumm. Musc. Am. S. States, 137; Sull. Musc. Allegh. 4; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 137; Austin, Musc. Appal. 297; Grout, N. Am. Musc. Pl. 235, 270.

On rotten wood and bases of trees, frequently on earth and stones, especially in the southern range. New Brunswick to Minnesota, south to Florida and Mexico, not rare.

9. THUIDIUM PYGMAEUM Bry. Eur. fasc. 49–51. Mon. 6. 1852.

Plants very small, dark dull green in thin felted mats; stems 1–2 cm. long, creeping, pinnately branched; branches pinnate, *capillary, papillose; paraphyllia simple, short, 2–5 cells long*, easily overlooked; stem leaves distant, triangular-ovate, narrowly acuminate, median leaf cells quadrate-hexagonal, 6 μ wide, pluripapillate; branch leaves 0.15 mm. long, ovate, obtuse, appressed-incurved when dry; costa ending below the apex. Monoicous; seta 1–1.5 cm. long; capsule oblong, unsymmetrical, inclined to horizontal, wide-mouthed; operculum conic, obliquely rostrate; annulus large; peristome perfect; spores in autumn. Type locality, Columbus, Ohio (Sullivant). Type at Kew in Herb. Schimper.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 98; Pl. 44.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 275, (Ed. 2) 408; Aust. Musc. Appal. 296.

On stones, rarely on soil in calciferous regions. New Jersey, Pennsylvania, Ohio; Canada.

10. THUIDIUM MICROPHYLLUM (Sw., Hedw.) Best, Bull. Torr. Bot. Club **23**: 87. 1896.

Hypnum microphyllum Sw. Prod. 142. 1788; and Hedw. Sp. Musc. 269. 1801.
Hypnum gracile Br. & Sch. Lond. Jour. Bot. **2**: 668. 1843 (name only). Also C. Muell. Syn. 2: 488. 1851.
Hypnum calyptratum Sull. Pacific R. Rep. **4**: 190. *pl. 10.* 1856.

Plants in rather thin spreading mats, medium-sized for the genus, light to yellowish-green, darker with age; stems 3–5 cm. long, with branching rather regularly pinnate; paraphyllia multiform; stem leaves broadly ovate to ovate-lanceolate, *gradually long and narrowly acuminate*, 0.75 to 1.2 mm. long, concave, biplicate; margins sinuate-serrulate or entire, plane or revolute; costa almost percurrent; median leaf cells quadrate-oblong to oval-rhombic, often hexagonal, rather thick-walled, the apical and a few of the basal more elongated, *unipapillate* with blunt papillae; branch leaves smaller, less slenderly acuminate; inner perichaetial leaves long-sheathing and long-acuminate, reaching 2.5 mm. in length, costate. Monoicous; seta reaching 2–2.5 cm. in length; capsule oblong, curved and inclined to drooping, about 2 mm. long, chestnut; operculum *conic-apiculate or obtuse;* annulus present; peristome perfect; spores in summer. Type locality, Jamaica (Swartz); type in Herb. Boissier.

ILLUSTRATIONS:—Hedw. l. c. *pl. 69, figs 1–5;* Sull. Icon. Musc. *pl. 100;* Jennings, Mosses W. Pa. *pl. 35;* M. H. M. *pl. 55.*

EXSICCATI:—Drumm. Musc. Am. 217, S. States 140–141; Sull. Musc. Allegh. 5; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 277, (Ed. 2) 410; Aust. Musc. Appal. 298; Grout, N. Am. Musc. Pl. 234.

On rotten wood, bases of trees, stones and soil. Vancouver Id., Manitoba to southeastern Canada; south to the Gulf, New Mexico and Arizona. Also in the West Indies. Infrequent in the North, very abundant in Florida. Quite variable, especially in size, shape of branch leaves and abundance of paraphyllia.

Forma PAPILLOSUM **n. f.** Branch leaves serrate above, serrulate almost to base; papillae of leaf cells very large and prominent.

On dry ground on side of Mt. Cutler, Colorado, alt. 7500 ft. July 25, 1910 (Dr. H. S. Jewett). Dr. Best in a letter to the author states that he has nothing like it and that it is a good variety.

Var. LIGNICOLA (Kindb.) Best, l. c.

Thuidium lignicola Kindb. Ottawa Nat. 4: 63. 1890.

Plants larger; paraphyllia abundant; stem leaves reaching 1.3 mm. or more in length, broader and more abruptly narrowed to long slender acumination, which is frequently as long as the body of the leaf, the cordate-ovate base often as broad as long. "Capsules mostly shorter and thicker" (Best).

Apparently with the range of the species.

In Warwick Hammock, near Miami, Florida, the author collected an extreme form of this variety on moist limestone and bases of trees. The body of the stem leaves was about the shape of *f. 3, pl. 54*, M. H. M. but the slender acumination was rather longer than the body of the leaf in the lower stem leaves.

Var. RAVENELII Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 279, is merely a reduced form growing on sand or in other unfavorable habitats, principally in the South.

Var. OBTUSUM **n. var.**

Size and appearance of robust *microphyllum*, lower stem leaves often resembling in outline those of *T. virginianum*, others acute and still others obtuse with three unipapillate cells at apex, all broadly ovate; costa percurrent or nearly so, very stout; branch leaves ovate, gradually narrowed to an obtuse apex, some short-acuminate, serrulate above, costa ending below apex.

Type from Altamaha River swamp, north of Jessup, Georgia, July, 1895 (John K. Small, no. 5069). In herb. A. J. G.

Freaks occur in almost all forms of life. While the plants of this collection have all the appearance of normal healthy plants, it does not seem wise to make a new species on a single collection of a sterile moss until one is sure the variations are established.

11. THUIDIUM VIRGINIANUM (Brid.) Lindb. Musc. Scand. 36. 1868.

Hypnum Stereodon virginianus Brid. Bryol. Univ. **2**: 576. 1827.
Hypnum gracile lancastriense Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 278.
Thuidium punctulatum De Not. Erbar. Critt. Ital. no. 909. 1863; and Limpricht, Laubm. **3**: 808. 1903.

Plants small to medium-sized, in intertangled mats, dark to dirty green; stems irregularly divided, 2–4 cm. long, creeping, pinnately branched; paraphyllia multiform, frequent on the branches; stem leaves rounded-ovate, 0.6–0.8 mm. long, *abruptly short-acuminate*, concave, rounded at base and narrowed to the insertion, scarcely plicate; margins plane or recurved below, *serrate above, erose-dentate below;* costa vanishing in the acumination; leaf-cells oblong-quadrate to hexagonal, with *a single stout broad papilla*, which is occasionally bifurcate; branch leaves crowded, about 0.4–0.6 mm. long, less abruptly narrowed to *an acute apex* or *a broad short acumination, serrate above;* perichaetial leaves erect, reaching 2.5 mm. long, margins denticulate-serrate. Monoicous; seta slender, 2–2.5 cm. long, dark-chestnut; capsule oblong-cylindric, somewhat lighter colored than the seta, curved, inclined to horizontal; urn about 2.5 mm. long, lid obtusely short-rostrate, about ⅓ the length of the urn; annulus large; peristome perfect; spores in spring. Type locality, Virginia (Bannister and Mitchell).

ILLUSTRATIONS:—Bull. Torr. Bot. Club 23: *pl. 261;* M. H. M. *pl. 54.*

EXSICCATI:—Sull. & Lesq. l. c. and (Ed. 2) 411; Aust. Musc. Appal. 200; Grout; N. Am. Musc. Pl. 172.

On the ground or roots of trees in open woods; New England to Minnesota, south to Mexico, much less frequent than the preceding and often confused with it. As a rule it is smaller than *T. microphyllum*, with leaves more crowded. The stem leaves are often more slenderly acuminate than is shown in Sullivant's figures (M. H. M. *pl. 54*). The distinguishing characters of the species are, abundant paraphyllia, acute or abruptly short-acuminate leaves and large papillae. Slender forms occur with branch leaves more distant and more slenderly acuminate.

RHYTIDIADELPHUS TRIQUETRUS

PLATE XXX.

PLATE 30. *A. Rhytidiopsis robusta.* 1, stem leaf × 9; 2, basal leaf cells × 175; 3, leaf cells more enlarged; 4, paraphyllia × 175 (from Engler & Prantl, Musci (Ed. 2) **2:** 478. *f. 761*).

B. Rhytidiadelphus triquetrus. *P*, plant; *B*, branches; 1, 1*a*, 1*b*, etc., portions of leaves and leaf cells; 3, perichaetial leaf; 8, peristome; sp, spore; the capsule and seta are numbered 5. (From Jennings, Mosses W. Pa. *pl. 43.*)

C. Rhytidiadelphus loreus. Above, portion of stem; 6 and 7, leaves; 7*a* and 7*b*, apex and base of the same; 14, perichaetial leaf (from Bry. Eur. *pl. 490*).

PLATE 31. *Hylocomium splendens.* 1, stem leaf; 2, branch leaf; 1*b* and 1*c*, portions of stem leaf. The other figures are self-explanatory. (From Jennings, l. c.).

Hylocomium brevirostre. Explanation of the figures as above. (From Jennings, l. c. *pl. 44.*)

A. Hylocomium alaskanum. Leaves and leaf cells after Williams, Bryologist, **22:** 1. *f. 1.*

B. Hylocomium pyreniacum. 4 and 5, leaves; 6 and 7, leaf cells. (From Sull. Icon. Musc. *pl. 102.*) 7 (a duplication) and 8, leaf and paraphyllia from Bry. Eur. *pl. 489.*

PLATE XXXI.

PLATE XXXII.

PLATE 32. *A*. *Hypum subimponens*, from Sull. Icones Suppl. *pl. 79*. 1, plant × 1; 2, part of a branch; 3, leaves; 4 and 5, cells of base and apex; 8, capsule.

Hypnum Vaucheri, from Husnot, Musc. Gall. *pl. 117*.

Hypnum circinale, *figs. 3–6* (from Hook. Musc. Exot. *pl. 107*). figs. 1–2, leaf base × 100 and angular cells × 400 (by Mrs. Cleaves).

Upper right (lettering omitted by mistake), *Hypnum callichroum;* leaves and areolation (from Bry. Eur. *pl. 506*).

PLATE 33. *A*. 1, stem leaf of *Hypnum canadense* from Allen, Mosses Cascade Mts. 121b; 2, same of *H. canadense* from Vancouver Id., det. Kindb.; 3, same of *H. Dieckii*, det. Cardot, N. Am. Musci. *Pl. 99*. All × 30. (Drawings by Mrs. Cleaves.)

B. *Hypnum subplicatile* (from Bot. Gaz. 22: *pl. 5*, as *H. implexum* R. & C.); *a*, entire plant, *b*, *b*, *b*, stem leaves, *c*, *c*, *c*, branch leaves; *d*, angular cells; *e*, leaf apex.

C. *Hypnum pallescens* (from Sull. Icones Suppl. *pl. 68* as *Rhynchostegium Jamesii*); 2, part of stem with leaves; 4, leaf; 5, cross section of same; 6, leaf apices; 7, leaf base; 10 and 11, capsules.

(At bottom) *H. pratense* (from Bry. Eur. *pl. 29*); 4–7, stem leaves, 2, 3, branch leaves; 8, paraphyllia. The other figures are self-explanatory.

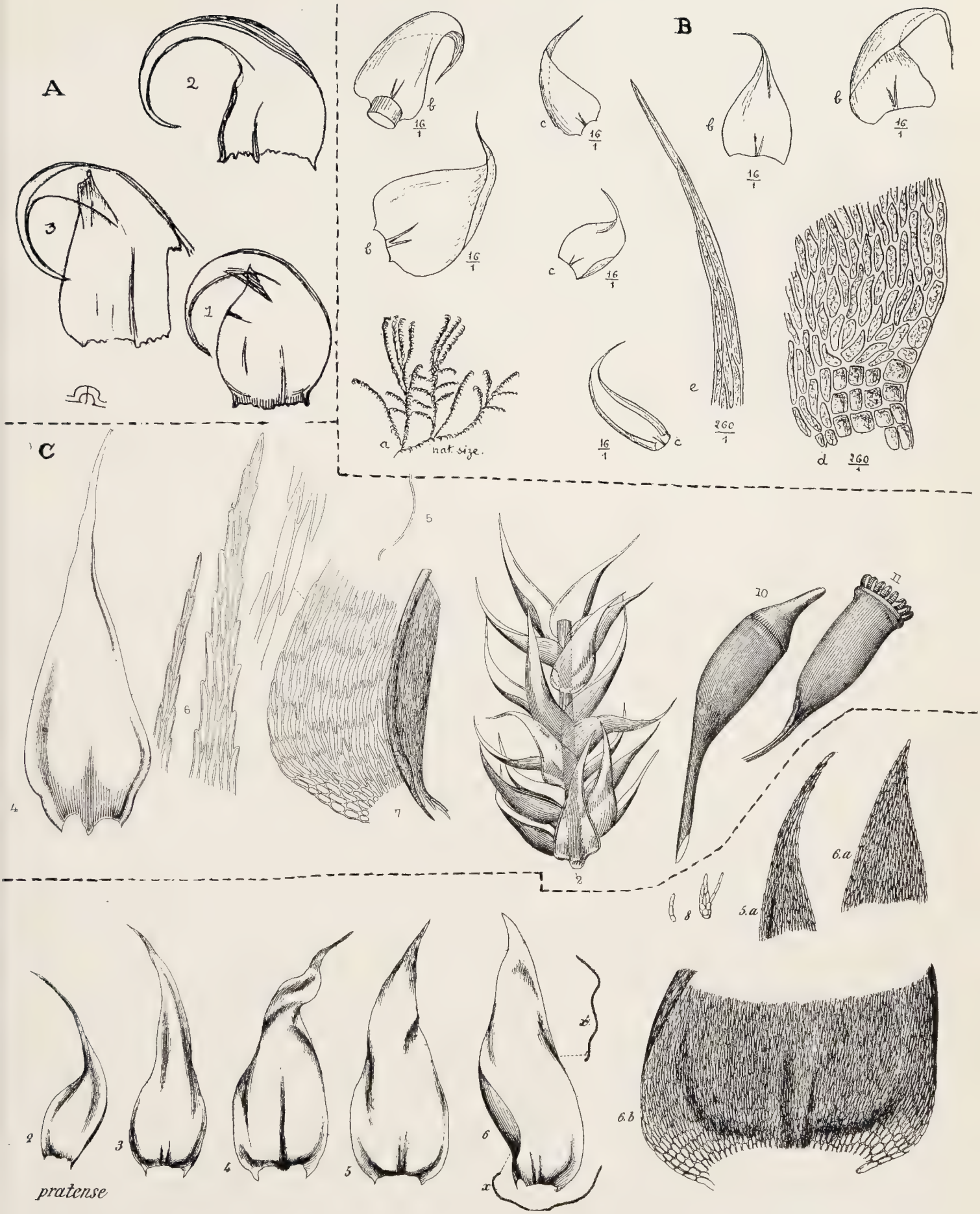

PLATE XXXIII.

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4.b
fastigiatum

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4.b
nemorosum

PLATE XXXIV.

PLATE 34. *Hypnum nemorosum* (from Bry. Eur. *pl. 593*) 3–5, stem leaves; 6–8, branch leaves; 9, paraphyllia; 10, portion of stem bearing antheridia and archegonia; 11–14, perigonial leaves and antheridia; 15–16, perichaetial leaves; 4*b*, basal cells of 4; 3*a*, 4*a* and 8*a*, apical cells of 3, 4 and 8, respectively.

Hypnum fastigiatum (Bry. Eur. *pl. 589*). 2–4, leaves; 4*a*, 4*b*, cells of base and apex respectively of 4; 5, paraphyllia.

PLATE 35. *A. Brotherella recurvans* (from Bryol. **6**: *pl. 1*). 1, plant enlarged; 2, portion of branch; 3, leaf; 4 and 5, cells of base and apex of 3; 7, perichaetial leaf; 8, antheridia.

B. Brotherella tenuirostris (from Sull. Icones *pl. 109*, as *Hypnum cylindricarpum*). 1, plant, natural size; 6–7, leaves; 10, cells of leaf apex; 9, cells of leaf base; 13, perichaetial leaf; 15, 16, 17, capsule, calyptra and operculum, respectively; 18, 19, peristome.

E. Hypnum revolutum.

F. Hypnum hamulosum.

H. Hypnum Bambergii.

I. H. canariense.

J. Hypnum procerrimum.

Figures *E–J*, from Dixon and Jam. Handb. Brit. Mosses, *pl. 59*.

G. Pylaisia polyantha, from the same, *pl. 51*.

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PLATE XXXV.

PLATE XXXVI.

PLATE 36. *Sematophyllum carolinianum.* The leaves shown are all branch leaves and the other figures are self-explanatory (from Jennings, Mosses W. Pa. *pl. 48*).

At the left, figures 1–11, *Sematophyllum Smallii.* 1, plant × 1; 2, plant × 10; 3, stem leaf × 36; 5, empty capsule × 36; 7, part of peristome × 300; 8, inner perichaetial leaf × 36; 11, median exothecial cells × 200 (from Bryol. **23,** *pl. 6*).

Above to the right, 1–5, *Sematophyllum caespitosum* (by Mrs. Cleaves). 1 and 2, leaves × 35; 3, alar cells × 200; 4 and 5, median and apical cells × 170; 6–8, leaves of *Homomallium mexicanum latifolium;* 9, branch leaf of the same; all × 33 and from the type; 10, leaf of *H. mexicanum* × 33 (by Mrs. Cleaves).

PLATE 37. *A* (lower left). *Thuidium abietinum;* leaves and basal areolation (from Bry. Eur. *pl. 485*).

B. Pylaisia subdenticulata. 2, branch. The other figures are self explanatory (from Sull. Icones, *pl. 87*).

C. Plagiothecium Groutii; a, plant × 1; *b,* stem leaf × 26, *e,* apex of same × 135; *f* and *g,* median and basal leaf cells of stem leaf × 200; *b,* branch leaf × 26; *d,* apex of same; *i,* ripe moist capsule (from Bot. Gaz. 37: *pl. 24*).

D. Leaf of *Pylaisia Jamesii* × 30. The shaded area represents quadrate alar cells.

Thuidium minutulum. 1, stem leaf; 2, branch leaf; *s,* a bit of stem with paraphyllia. The other figures are self-explanatory (from Jennings, Mosses of W. Pa. *pl. 35*).

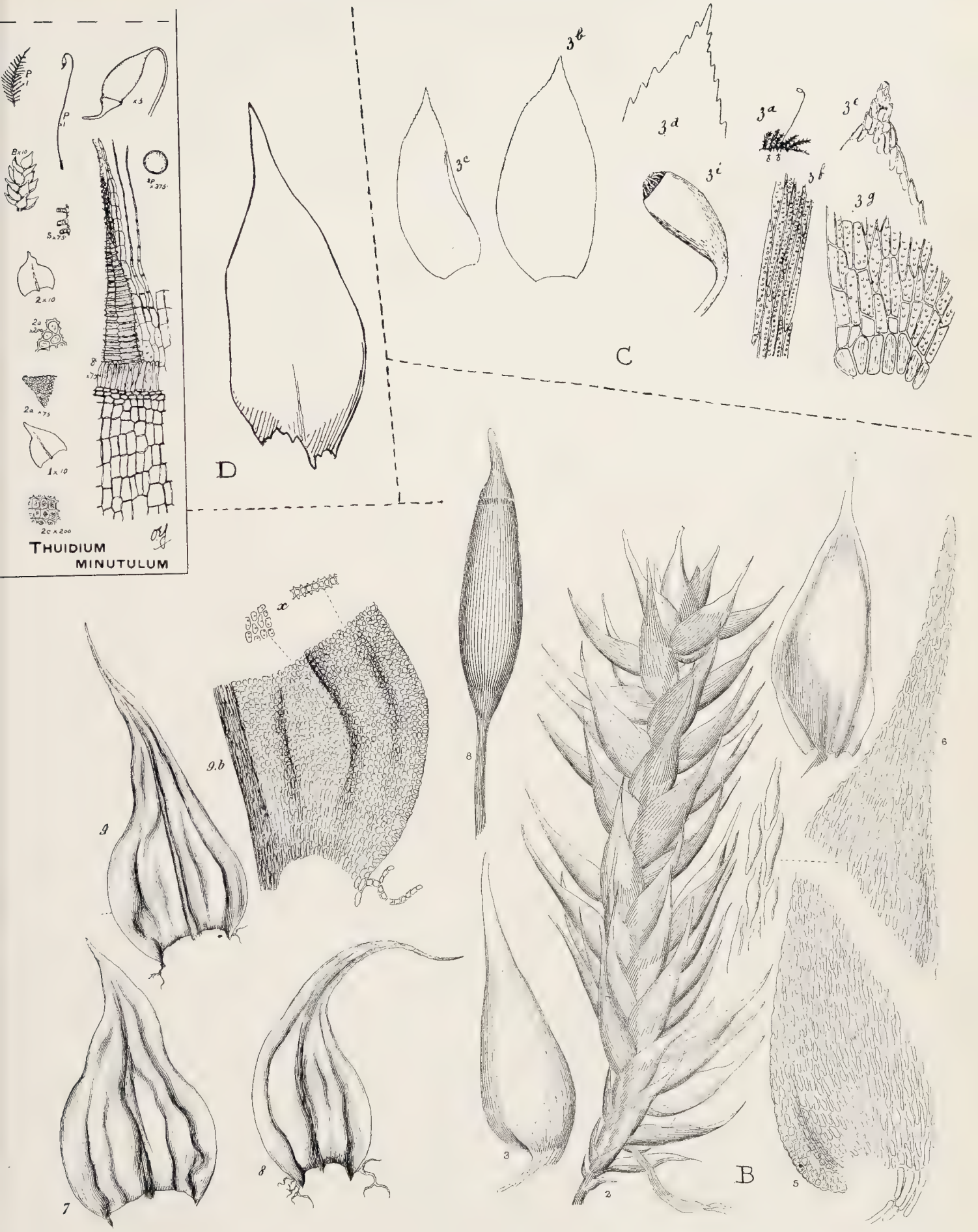


PLATE XXXVII.

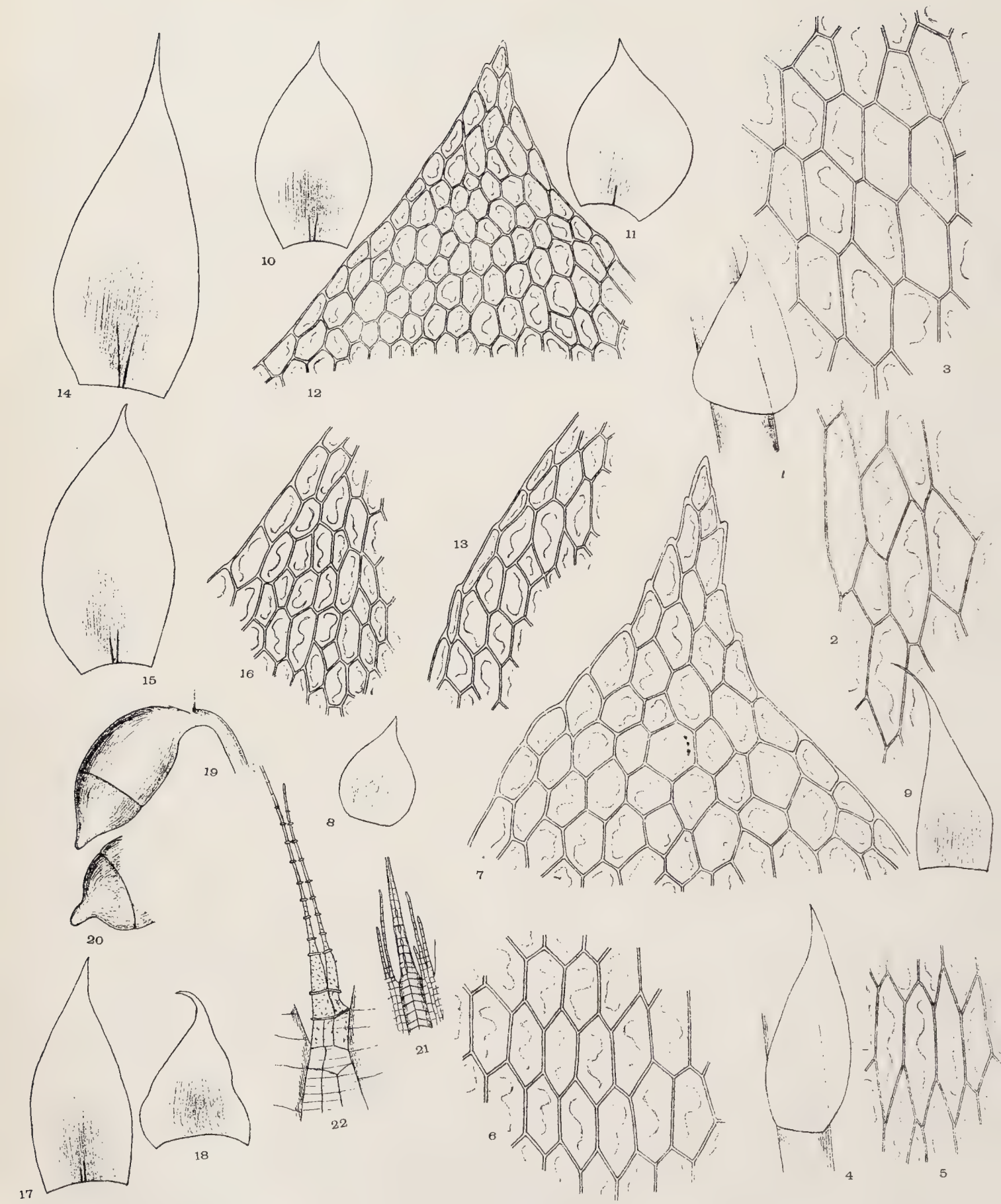


PLATE XXXVIII.

PLATE 38. *Vesicularia.* 1–3, 7–12, 17–22, *V. vescicularis.* 1, ventral branch leaf × 55; 2, areolation of the same at ⅓ from the apex × 360; 3, areolation of a dorsal branch leaf × 320; 7, apex of a dorsal branch leaf × 204; 8, ventral branch leaf, towards base of branch × 41; 9, perichaetial leaf × 20; 17 and 18, two stem leaves from the upper side of the stem; 19, moist capsule × 20; 20, dry operculum × 20; 21, part of inner peristome × 120; 22 cilia of the same × 204.

14–16, *V. vesicularis Poeppigiana.* 14 and 15, dorsal and lateral branch leaf × 41; 16, marginal areolation of lateral branch leaf at ¼ from the apex × 204.

4–6 and 13, *V. amphibola.* 4, ventral branch leaf × 55; 5, areolation of same at ⅓ from apex × 320; 6, areolation of dorsal branch leaf at ⅓ from apex × 320; 13, marginal areolation of lateral branch leaf at ¼ from the apex × 201 (all from Bull. Torr. Bot. Club **31:** *plates 13 and 14*).

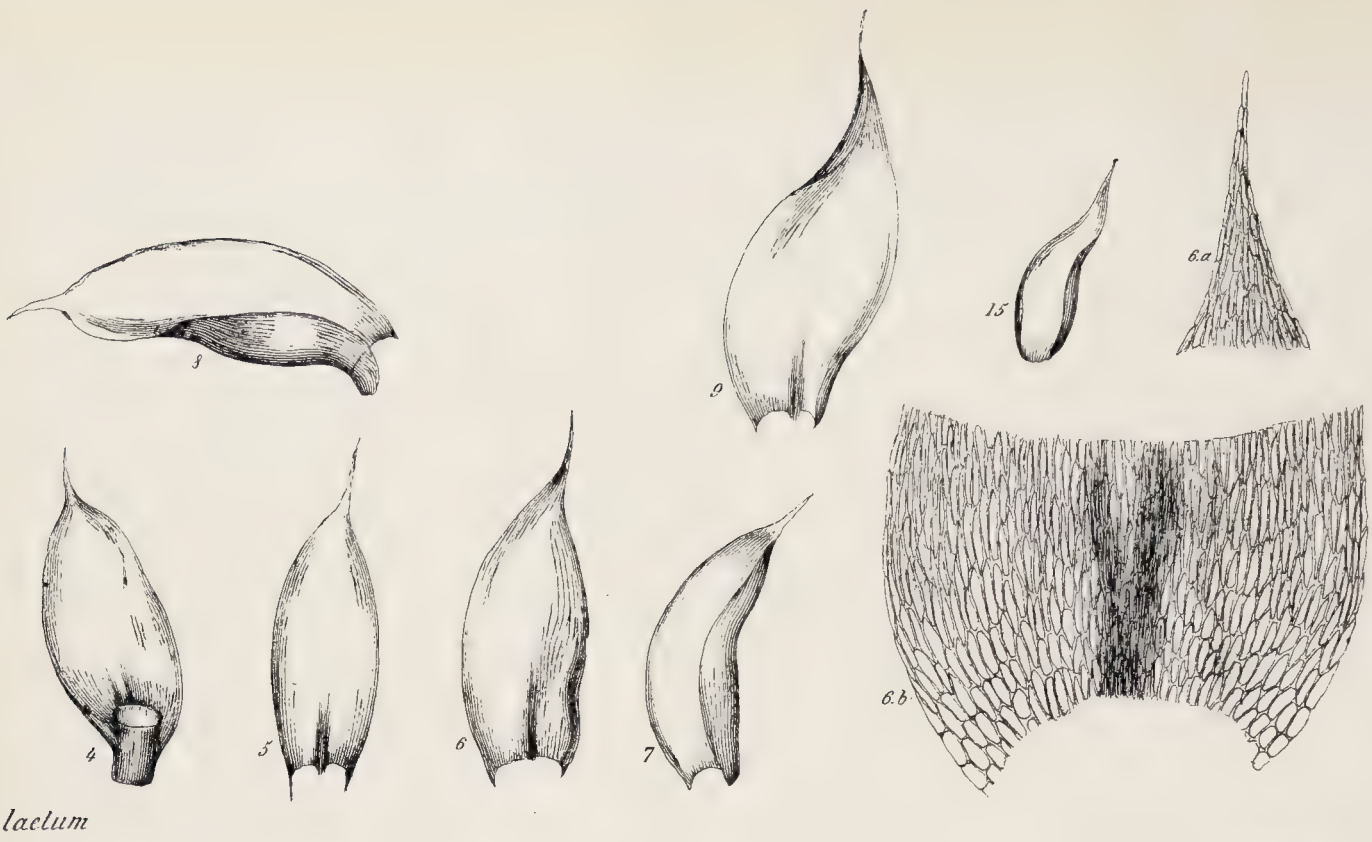
PLATE 39. *A*. *Ectropothecium caloosiense*. From drawings in the herbarium of The New York Botanical Garden made from the type. (By permission of the Director.)

B. *Stereophyllum Wrightii* (from Sull. Icones, *pl. 127*).

C. *Plagiothecium Roeseanum* (from Sull. Icones, *pl. 126*).

D. *Plagiothecium latebricola* (from Dixon and Jam. Handb. Brit. Mosses, *pl. 56*).

PLATE XXXIX.



laetum

undulatum

piliferum

PLATE XL.

PLATE 40. Leaves and areolation of leaves of *Plagiothecium laetum*, *P. undulatum* and *P. piliferum* (from Bry. Eur. plates 495, 506 and 496, respectively).

PLATE 41. *Holmgrenia chrysea.* 2, leaf; 4, cross section of leaf; other figures self-explanatory (from Husnot, Musc. Gall. *pl. 90*).

Holmgrenia intricata. Figures 1–6. Figures 7–9 represent Husnot's idea of *H. stricta;* 10 and 11. *H. intricata* var. *binervula* (from Husnot, l. c.).

Lower left, *Holmgrenia intricata.* 8, leaf; 6*a* and 6*b*, apex and base of same; 14, perichaetium; 15–19, perichaetial leaves (from Bry. Eur. *pl. 462*); 17 also well represents a common type of branch leaf.

Right, *Entodon orthocarpus* (from Bry. Eur. *pl. 465*).

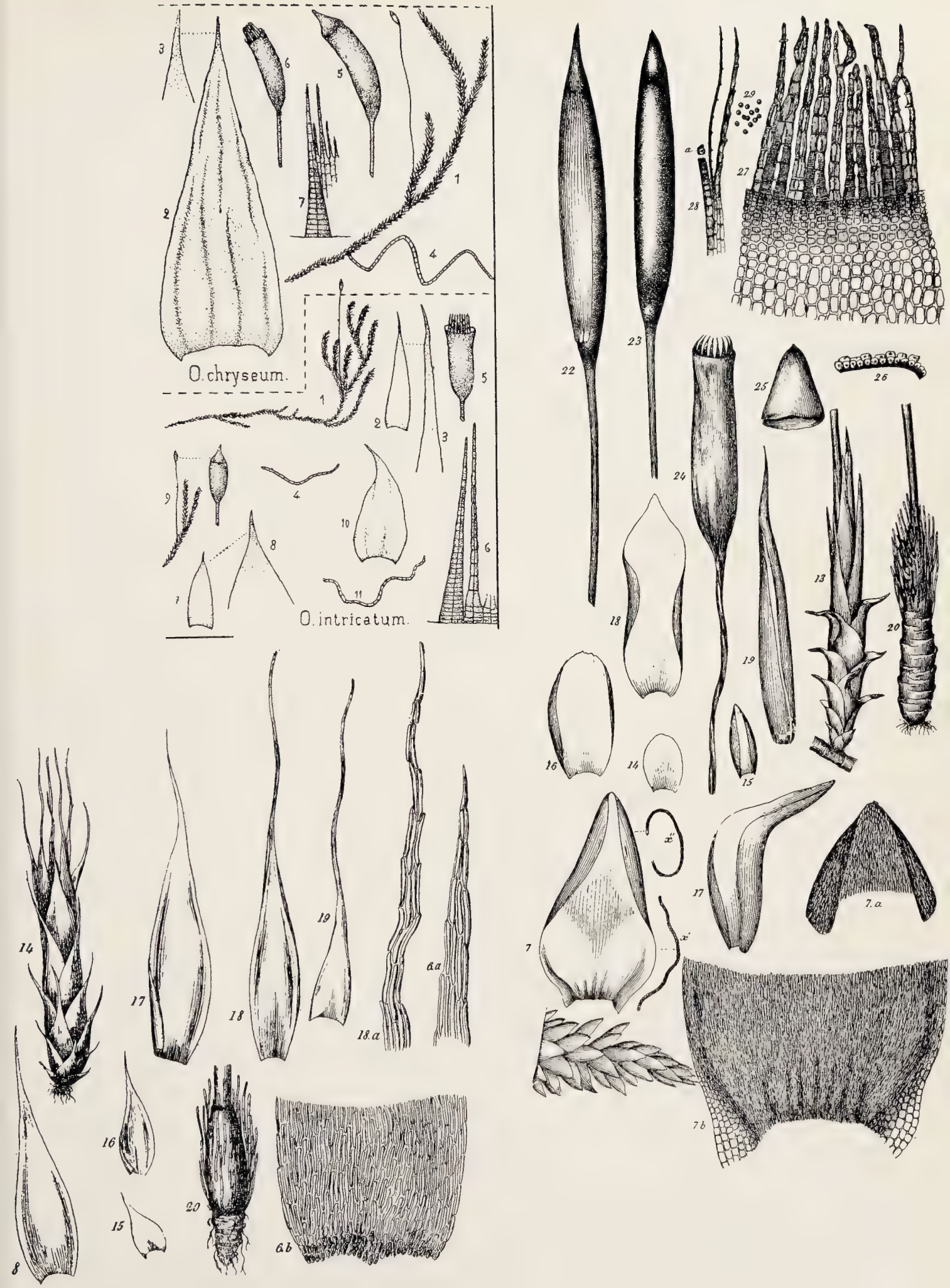


PLATE XLI.

PLATE XLII.

PLATE 42. *A. Plagiothecium Seligeri.* 1 and 2, leaves × 21; 3, alar cells × 200.

B. Plagiothecium deplanatum. 1–4, leaves × 21; 1, from Musc. Bor.-Am. (Ed. 1), 396; 2, a short-acuminate leaf from a specimen from Burlington, Vt.; 3, leaf from Musc. Pl. 74; 4, leaf of var. *ovatum* from Arizona; 5, alar cells of 3 × 133; 6, axillary paraphyllia × 21.

C. Mittenothamnium diminutivum. 1, branch × 21; 2, stem leaf × 21; 3, median leaf cells × 200.

D. Taxithelium planum. 1, stem leaf × 21; 2, branch leaf × 21; 3, alar cells × 200; 4, median cells × 200.

E. Stereophyllum Donnellii. 1, leaves × 21; 2, alar cells × 166 (from the type).

F. Platygyrium fuscoluteum. 1, leaf from the type × 21; 2, leaf from a plant from Arizona (Bartram) × 21; 3, alar cells × 300.

G. Thuidium Alleni. 1, apex of stem leaf × 166; 2, stem leaf from plant from Florida; 3, stem leaf from plant from type locality, both × 21; 4, portion of branch × 21; 5, portion of stem × 8.

H. Thuidium involvens. 1, plant × 2; 2, apex of leaf × 200; 3, branch × 21.

I. Tripterocladium leucocladulum. 1, branch leaf × 21; 2, stem leaf × 21, shaded areas at basal angles indicate area of quadrate cells, both 1 and 2 from the type; *2a* and *2b*, apical and median cells of 2 × 200; 3 and 4, leaves from type of *T. compressulum;* 5 and 6, capsules of *T. leucocladulum* from Idaho, both from the same tuft of plants, × 18. (All figures in *Pl. 42* were drawn by Mrs. Howard Cleaves.)

PLATE 43. *A*. *Plagiothecium Seligeri*. 1, leaf; 1*a* and 1*b*, apical and basal cells of the same (from Bry. Eur. *pl. 500*).

B. Portion of branch, leaves and leaf cells of *Entodon brevisetus* (from Sull. Icones *pl. 96*).

C. Portion of stem, leaves and leaf cells of *Plagiothecium subfalcatum* (from Sull. Icones Suppl. *pl. 67*).

D. Leaves and leaf cells of *Entodon Drummondii* (from Sull. Icones *pl. 94*).

E. Leaf, leaf cells and capsule mouth of *Entodon Sullivantii* (from Sull. Icones *pl. 95*).

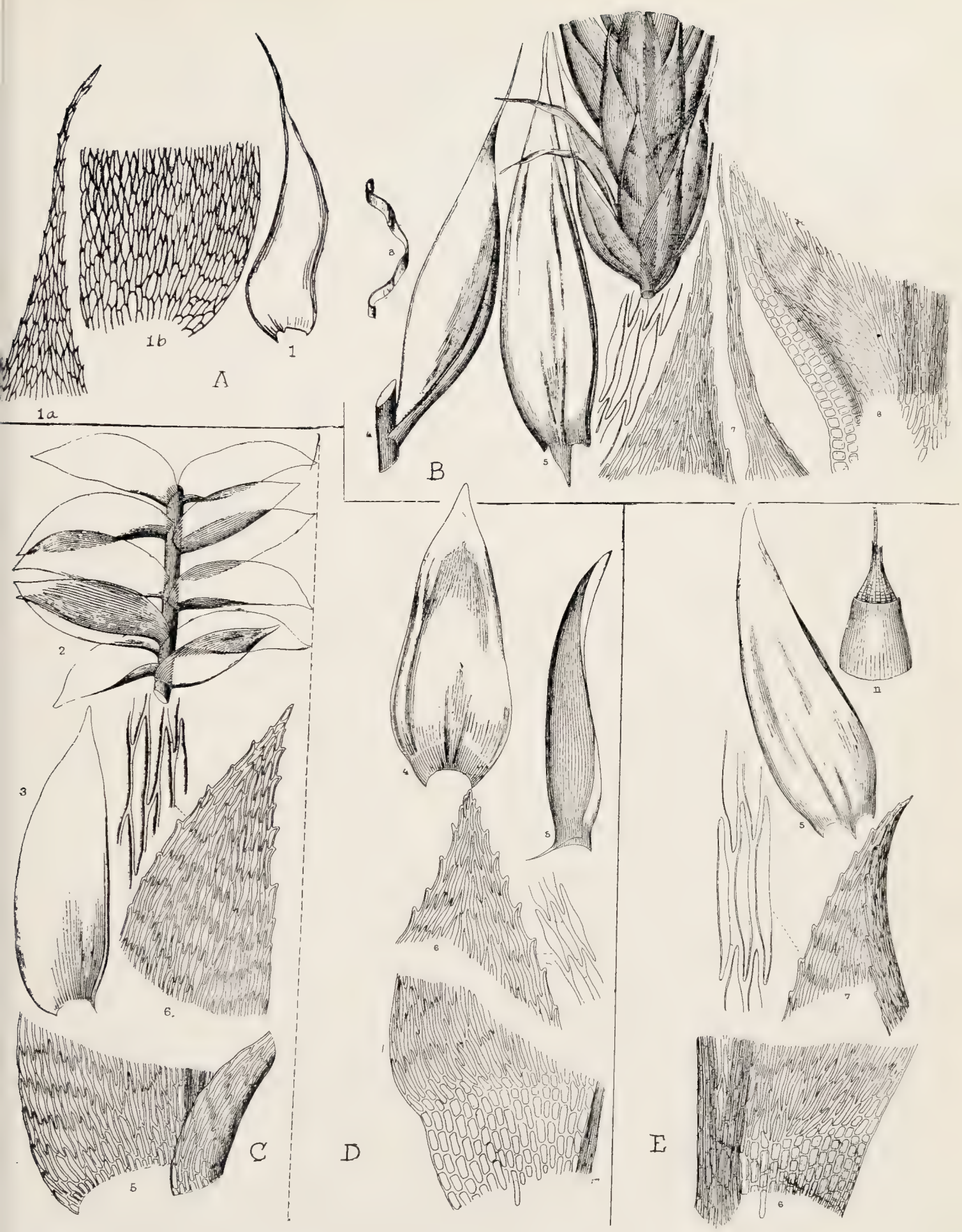


PLATE XLIII.

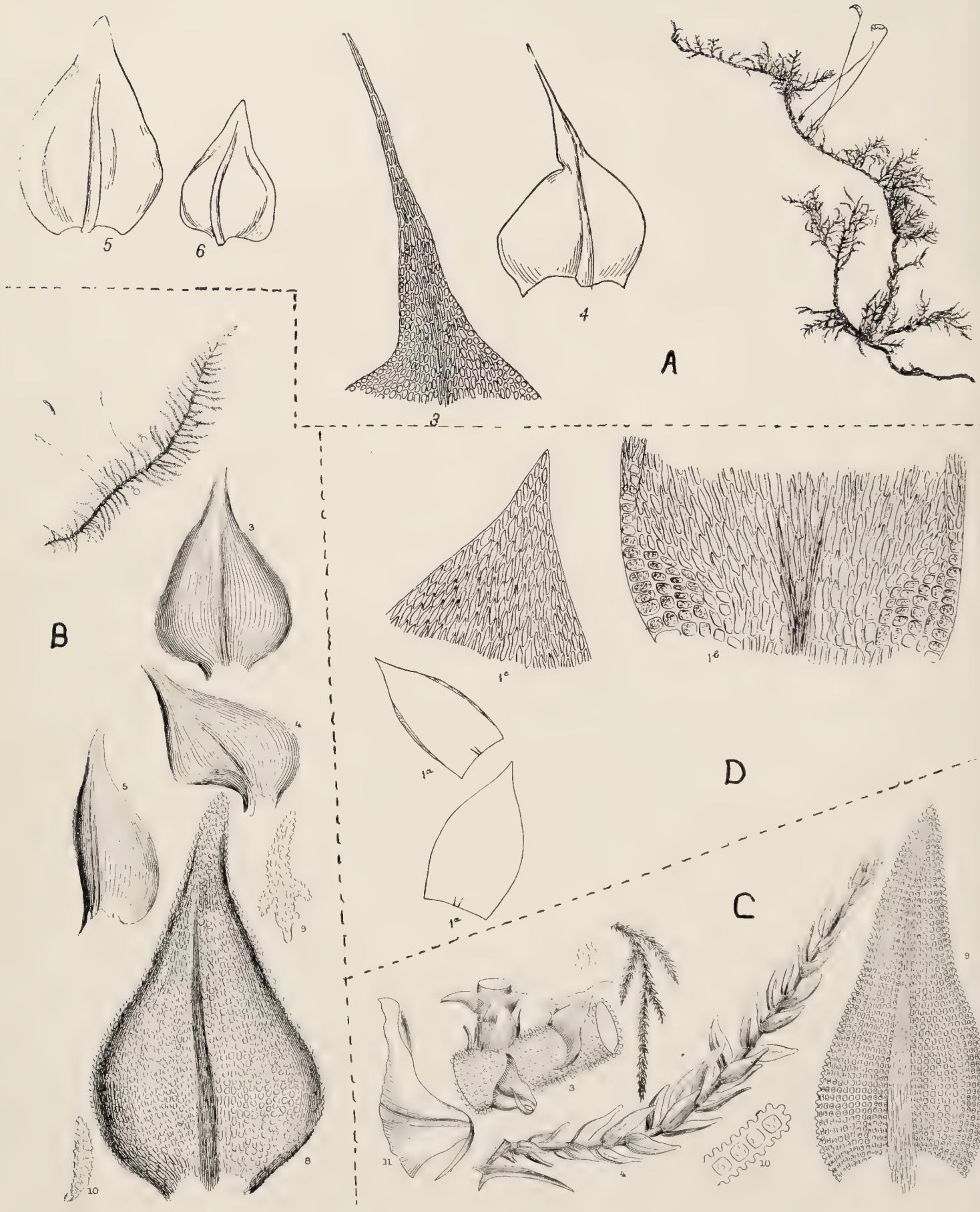

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PLATE 44. *A. Thuidium Philiberti.* Plant, stem leaf, apex of the same and branch leaves (from Bull. Torr. Bot. Club **23**: *pl. 260*).

B. Thuidium scitum. Plant, leaves, leaf cells and paraphyllia (from Sull. Icones *pl. 99*).

C. Thuidium pygmaeum. Portion of stem, branches, apex of stem leaf, branch leaf showing cells, and portion of cross section of leaf (from Sull. Icones *pl. 98*).

D. Pterogonium ascendens. Leaves and leaf cells from drawings made by Cardot from type specimens in Herb. Boissier, collected in Pennsylvania by Muhlenberg (from Bull. Herb. Boissier **7**: *pl. 8.* 1899).

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

A. J. GROUT, PH.D.

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LESKEA and PSEUDOLESKEA

BY

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FONTINALACEAE

BY

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VOLUME III

Part 4

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THUIDIUM SCHISTOCALYX (C. Muell.) Mitt. Jour. Linn. Soc. **12**: 575. 1869.

Hypnum schistocalyx C. Muell. Syn. **2**: 691. 1851.

Plants very similar to *T. minutulum* and readily mistaken for it when sterile; the stem leaves are more distant; the branches are often regularly pinnately branched and frondiform; branch leaves obtusely acute; leaves of branchlets 0.1–0.15 mm. long, oval, *obtuse;* papillae much smaller; *perichaetial leaves ciliate* and *seta rough*. Dade Co., Florida (Small); det. Dr. Best. Although the specimens were sterile there seems no doubt of the determination.

The statement on p. 177, that the paraphyllia are few on the stems of *T. minutulum*, is scarcely correct.

The Florida specimens of *T. schistocalyx* were discovered after pt. 3 was completed. The species will key out to *T. minutulum* in the key on p. 174.

**2. HELODIUM (Sull.) Warnst. Laubm. Krypt.-fl. Mark. Brand. 692. 1905.

Elodium Sull. Mosses U. S. 68. 1856. (As a subgenus).

Plants in deep soft tufts, green to yellowish green, or brownish, especially below; stems mostly simple and erect or nearly so, regularly pinnately branched above (except *H. paludosum*), densely foliate; central strand lacking; branches slender, attenuate; paraphyllia dense, filamentous, freely branched; leaves appressed when dry, erect-spreading when moist, concave with a dorsally projecting plication; costa extending to middle or beyond; leaf cells translucent, elongated-hexagonal to nearly linear, smooth or unipapillate over the lumen or at the upper angle. Autoicous or rarely dioicous; capsule inclined to horizontal, oblong-cylindric, curved; annulus present; peristome perfect hypnaceous, with 3 cilia. Type species, *H. Blandowii*.

KEY.

Plants very regularly pinnate; costa vanishing above leaf-middle; leaf cells with a large papilla at the distal angle ..... *1. Blandowii.*

Plants often irregularly pinnate; costa nearly percurrent, leaf cells with a small papilla at the distal angle or smooth ..... *2. paludosum.*

1. HELODIUM BLANDOWII (Web. & Mohr) Warnst. l. c.

Hypnum Blandowii Web. & Mohr, Bot. Taschenb. 332. 1807
Hypnum lanatum Ström, D. Vid. Selsk. Skr. Ny samml. 38 and *pl. 11* n. 6 (1791).
Thuidium Blandowii Bry. Eur. fasc. 49–51. 1852.
Thuidium pseudo-abietinum Kindb. Cat. Can. Pl. **7**: 285. 1902. (Type seen).

Plants *large*, in dense soft masses, yellow-green to brownish below; stems 5–10 cm. long, erect, rigid, simple or divided, closely and regularly pinnately branched; branches simple, spreading or recurved, attenuate, ± 1.2 cm. long; stems and branches covered with a tomentum of paraphyllia, long-filamentose from an oblong-linear base; stem leaves 1–1.3 x 0.75–0.9 mm., appressed when dry, ovate-triangular, narrowly acuminate, deeply concave, sulcate, abruptly contracted to a *subclasping decurrent base* bearing paraphyllose appendages; margins entire or sinuate-serrulate, sometimes revolute above; costa vanishing above the middle; median leaf cells oblong-fusiform to linear-rhomboidal, 6–7 μ wide, 3–6 : 1, with a large papilla at the distal end on the dorsal surface, nearly or quite smooth above; basal broader, rectangular, smooth; branch leaves ovate-lanceolate, subcrispate. Monoicous; seta 3–5 cm. long; capsule oblong-cylindric, 3–4 mm. long, curved, nearly horizontal, reddish, strongly contracted and incurved under the mouth when dry and empty; operculum conic-apiculate; inner peristome with 3 cilia; spores in July.

Type locality, Mecklenburg, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl. 486;* M. H. M. *f. 132, pl. 52, f. 4 & 5.*

EXSICCATI:—Drum. Musc. Am. 215; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 414; Aust. Musc. Appal. 305; Grout, N. Am. Musc. Pl. 222 and 230. On wet marshy ground in northern N. America from New Jersey, Ohio, Colorado, Idaho and Washington, northwards. Dr. Best in his monograph (Bull. Torr. Bot. Club. vol. 23) remarks that the next is probably a derivative of this and that puzzling intermediate forms occur.

*The Greek-derived *elodes* demands the aspirate in Latin according to classical authorities.

2. Helodium paludosum (Sull.) Aust. Musc. Appal. 306. 1870.

Hypnum paludosum Sull. Musc. Allegh. 7. 1846.
Thuidium paludosum Rau & Hervey, Cat. 38. 1880.

Plants smaller than in the last; stems 4–6 cm. long, branching usually irregularly pinnate, with branches more irregular in length; paraphyllia much as in the last; stem leaves 1–1.3 mm. long, erect-spreading when moist, plicate-striate, oblong-lanceolate to ovate-lanceolate, narrowed to the scarcely decurrent base which often bears filaments; margins revolute below, sinuate-serrulate above; costa nearly percurrent; median leaf cells oblong to linear-rhomboidal, ± 6 x 45 μ, smooth on both surfaces or with a small papilla at the distal end of each cell below, rarely on the upper surface also; branch leaves narrower and smaller, less slenderly acuminate. Monoicous; seta 1.5–3 cm. long; capsule and peristome as in *H. Blandowii;* spores in May.

Type locality, Ohio. Type in the Sullivant collection at the Gray Herbarium of Harvard University.

Illustrations:—Sull. Icon. Musc. *pl. 101.* M. H. M. *pl. 53;* Jennings, Mosses W. Pa. *pl. 36.*
Exsiccati:—Sull. Musc. Allegh. 7; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 281, (Ed. 2) 415; Aust. Musc. Appal. 306; Grout, N. Am. Musc. Pl. 156.

On the ground in swamps and wet grassy places, New England to Ontario and south to Illinois and North Carolina.

Var. Helodioides (R. & C.) Grout, Ck. List 23, 1929.

Thuidium elodioides R. & C. Hedwigia **32:** 251 in separate, 308 in original. 1893.

Often dark green, leaves smaller, leaf cells shorter, more strongly papillose, often on both surfaces with subcentral papillae; margins often dentate-serrate. Type from Indiana (Röll).

Although the type of Kindberg's *Thuidium pseudo-abietinum* is *H. Blandowii*, several other specimens in his herbarium named *pseudo-abietinum* were *H. paludosum.*

Helodium paludosum is exceedingly variable. Some plants are as slender as *Eurhynchium praelongum*, with a percurrent or slightly excurrent costa; others are as stout as *Brachythecium oxycladon*, with leaves of almost the same shape and concavity, bisulcate at base and with short subquadrate alar cells. Some plants are regularly pinnate with shorter branches than *Blandowii*, others are not noticeably pinnate.

3. CLAOPODIUM (Lesq. & James) R. & C., Musc. Am. Sept. 50. 1893.

Claopodium Lesq. & James, subgenus of *Hypnum*, Manual, 327. 1884.

Plants small to rather large, resembling *Thuidium* in general appearance; stems creeping, stoloniferous; paraphyllia when present scale-like; stem leaves triangular-lanceolate to broadly ovate, long and narrowly acuminate, margins plane, dentate-serrate (except *C. pellucinerve*), with single strong translucent costa; leaf cells small, round-hexagonal to rhombic, thickened-papillate on both surfaces, making the cells obscure as in *Anomodon.* Dioicous; seta roughened (except *C. pellucinerve*); capsules oblong-ovoid, unsymmetric, inclined to subpendent; annulus present, large; operculum long-conic to -rostrate; peristome perfect hypnaceous, with cilia 1–3; spores smooth.

Distinguished from *Thuidium* by the lack of filamentose paraphyllia and from *Anomodon* by the hypnaceous capsules and peristome. Plants confined to the region of the Rocky Mts. and westward. Type species, *C. Whippleanum.*

Key.

1.	Plants small; leaves not hair-pointed	*1. Whippleanum.*
	Plants mostly larger; leaves hair-pointed	2.
2.	Plants largest of the genus; leaf cells with a single large subcentral papilla on each surface	*2. crispifolium.*
	Plants smaller; leaf cells with two or more smaller papillae on each surface	3.
3.	Stems papillose; seta smooth	*4. pellucinerve.*
	Stems smooth except below basal leaf angles; seta rough	*3. Bolanderi.*

1. Claopodium Whippleanum (Sull.) R. & C., l. c.

Hypnum Whippleanum Sull. Pacific R. R. Rep. **4:** 190. 1856.
Thuidium leskeoides Kindb. Bull. Torr. Bot. Club. **17:** 277. 1900.

Plants in rather thin spreading mats, deep to dark green; stems 2–4 cm. long, creeping, stoloniferous, sometimes flagellate, irregularly pinnately branched; stem leaves ± 1 mm. in length, ovate-lanceolate to lanceolate, gradually narrowly long-acuminate, slightly decurrent; margins plane, dentate below, sharply serrate above; costa subpercurrent; lower leaf cells oblong-rectangular to linear-rhomboidal, irregularly quadrate-oblong at basal angles; median indistinctly rhombic to irregular, 6–7 μ wide, for the most part distinctly longer than broad, often 2: 1, all except the very lowest with one or more large papillae on each surface; marginal elongated, curvilinear, usually without chlorophyll, paraphyllia few or lacking; branch leaves smaller and shorter acuminate, those of the terminal branches more or less complanate, loosely spreading, rather irregularly contorted when dry. Seta rough, ± 1 cm. long; capsule oblong-ovoid, horizontal, subpendent and contracted under the mouth when dry and empty; operculum conic, short-rostrate, urn 1.5–2 mm. long, 1.5–2 : 1; operculum ± 1 mm. long; spores in spring.

Type locality, California. Type in the Sullivant Collection at Harvard University.

ILLUSTRATIONS:—Sull. l. c. *pl. 9* (in part); *Pl. 46B.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 407; Grout, N. Am. Musc. Pl. 131.

On rocks and banks, especially on shaded soil at base of trees and cliffs. California to Vancouver Island. "Rudimentary leaves, nearly destitute of papillae, with leaf cells linear-rhomboidal and costa vanishing in the middle, are not infrequent on stolons and flagella." Best Bull. Torr. Bot. Club, **24**: 429.

Var. LEUCONEURUM (Sull. & Lesq.) **n. comb.**

Thuidium leuconeurum Sull. & Lesq. in Sull. Icones Musc. Suppl. 104, *pl. 80.* 1874.
Claopodium leuconeurum R. & C. Musc. Am. Sept. 50. 1892.

In compact spreading tufts; stems 2–3 cm. long; branches often subjulaceous with appressed leaves; none of the leaves two-ranked, lanceolate to ovate-lanceolate, all as a rule less slenderly acuminate than in the species; seta minutely roughened to smooth, capsules small, ovoid; operculum long-conic to rostrate.

Apparently a reduced xerophytic form, intergrading and often intermingled with the species.* Type locality California. Type in Sullivant Collection.

ILLUSTRATIONS:—Sull. l. c. & Pacific R. R. Rep. **4**: *pl. 9* (in part); Sull. l. c.; *46A.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 407b; Grout, N. Am. Musci Pl. 377.
San Diego, California (MacFadden) to Washington (Foster).

2. CLAOPODIUM CRISPIFOLIUM (Hook.) R. & C., Musc. Am. Sept. 50. 1892.

Hypnum crispifolium Hook. Musc. Exot. **1**: *pl. 31.* 1818.
Hypnum ramulosum Hampe in Muell. Syn. Musc. **2**: 486. 1851.

In intertangled spreading mats, yellow-green above, reddish-brown below; stems 5–8 cm. long, irregularly divided, closely and rather regularly pinnately branched, not papillose; branches attenuate; paraphyllia few, serrate; stem leaves close, when dry crispate-incurved, when moist erect-spreading, incurved, reaching 1.8 x 0.7 mm. from a broadly ovate, auriculate subclasping decurrent base, abruptly contracted to a long linear-lanceolate acumination, considerably longer than the basal portion and ending in a long, more or less serrate, hyaline point; margins serrate-dentate to undulate-rugose; costa narrow, extending well into the acumination; median leaf cells small, 6 μ wide, short-oblong to rounded-quadrate, with a single large papilla on each face near the center; the basal-central clear, oblong-linear to rounded-rectangular, the very lowest smooth, incrassate and somewhat porose; upper marginal cells elongated; branch leaves smaller, lanceolate to ovate-lanceolate, rather gradually narrowed to the much shorter hair point. Seta 2.5–3 cm. long, very rough; capsules oblong-ovoid, inclined to horizontal; urn 2.5–3 mm. long; operculum long-rostrate; reaching 2 mm. in length; annulus large, deciduous; spores winter to early spring.

Type locality, west coast of North America, Menzies. Type in Hooker Herbarium at Kew.

ILLUSTRATIONS:—Hook. l. c.; Schwaegr. Suppl. 2^1: *pl. 143; Pl. 45.*
EXSICCATI:—Grout, N. Am. Musci Pl. 70 & 70a; Allen, Mosses Cascade Mts. 92.

On ledges, stones and soil. From California northwards, east to Idaho. The collections reported from Colorado by the author are *Helodium Blandowii*, which this species much resembles in gross appearance, but is otherwise quite unlike.

*See Dr. Best's remarks l. c. pp. 429 & 430.

An interesting fact is that a specimen collected at Mt. Tamalpais, Marin Co., California, April 17, 1893 by Dr. M. A. Howe and determined by him as *Hypnum leuconeurum* was later determined by Dr. Best as *C. Whippleanum.* So far as the author can determine, the plants have the subjulaceous branches and the short capsules of var. *leuconeurum* and at least one seta is entirely smooth but in some of the shorter capsules (about 1 mm. long) the *operculum is nearly as long as the urn!*

3. Claopodium Bolanderi Best, Bull. Torr. Bot. Club. **24**: 431. 1897.

The plants have much the appearance of the last but are a little smaller and more slender, the stems may reach an equal length and the leaves are nearly or quite equal in length. The ovate leaf base is relatively shorter and more abruptly contracted to the acumination; *the leaf cells are indistinct, with 2-5 small papillae* on each surface; the median cells of stem leaves are more evenly rounded-quadrate with diameter about 6 μ; the pellucid cells of the basal-central area are shorter and fewer, the lowest without papillae; the marginal cells of acumination are somewhat larger but scarcely twice as long as broad. Capsules a little smaller, urn about 2 mm. long and conic-rostrate operculum about 1.5 mm. long; cilia of peristome often poorly developed; spores autumn to winter.

Type locality, Marin Co., California (Bolander). Type in herbarium of Columbia University. *Pl. 45.*

Habitat and range the same as with the last; Alaska. Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 405; (Det. Best).

A well marked and distinct species in spite of its many resemblances to the last. Dr. Best says (l. c. 432) the leaves are not as abruptly contracted to the acumination, with which opinion the author differs.

Brotherus [Engler & Prantl, Musci (Ed. 2) 2: 317] says the stems are papillose; he is surely in error. The author has never found any such. Occasionally a bit of the decurrent leaf base may make the stem appear papillose.

4. Claopodium pellucinerve (Mitt.) Best, Bryol. **3**: 19. 1900.

Leskea pellucinervis Mitt. Musc. Ind. Or. 130. 1859.

Plants dark green, more slender than the last two as a rule; *stems and larger branches minutely papillose;* stem leaves ovate-lanceolate to elongated-triangular, rather gradually narrowed to a subhyaline hair-like point shorter than in either of the last two, ± 1 mm. long, cordate and decurrent at base,* occasionally slightly serrulate at apex; costa much as in the last two, papillose; median leaf cells oval-rhombic to oblong-hexagonal, about 6 μ wide, covered on both sides with small papillae more numerous than on the last: very few cells of the basal-central area somewhat larger, pellucid, papillose to the very base; marginal little or not at all differentiated. Mitten says the capsules are exactly like those of *C. Whippleanum* and Brotherus says the seta is smooth. Type locality, Simla, North India. Type in the Mitten Herbarium at the New York Botanical Garden. *Pl. 45.*

On rocks; Yukon Terr. (Williams); New Mexico (Standley, det. Best).

4. HETEROCLADIUM Bry. Eur. fasc. 49–51. 1852.

Plants medium-sized to rather small and slender; primary stems rigid, creeping, more or less stoloniform, sparingly paraphyllose; secondary stems with irregular, often flagelliform branches; leaves more or less papillose (smooth in *H. procurrens*); stem leaves triangular-ovate, cordate, subclasping, narrowly acuminate; branch leaves smaller, narrower, ovate to ovate-lanceolate, obtuse, acute or short-acuminate; costa short, double or forking, less frequently single and reaching the leaf middle. Dioicous; setae smooth; capsules inclined to horizontal, curved; annulus present; peristome perfect hypnaceous; basal membrane of inner peristome ⅓–½ height of teeth; operculum conic to rostrate.

Type species *H. heteropterum.*

Dr. Best in his monograph, Bull. Torr. Bot. Club. **28**: 123–131. 1901. says: "The short, thin, usually broad costa and the elongated, circumscribed leaf cells of the basal-central area separate the members of this genus from the closely related *Thuidia.*" The poorly developed costa also distinguishes this genus from the other genera of the Leskeaceae with which it is at all likely to be confused.

Key.

1. Stem leaves smooth ..... *1. procurrens.*
   Stem leaves more or less papillose ..... 2.
2. Apical cells of ultimate branch leaves smooth or with a single papilla ..... 3.
   Apical cells of ultimate branch leaves with at least 2 papillae ..... 4.
3. Branch leaves rounded-obtuse to subacute; leaf cells with a single papilla; operculum conic ..... *2. squarrosulum.*
   Branch eaves acute to acuminate; leaf cells often with 2 papillae; operculum rostrate ..... *5. heteropterum.*

*Brotherus [Engler & Prantl, Musci (Ed. 2) 2: 318] states that the leaves are not decurrent.

4. Leaves of secondary stems acuminate, cells of ultimate branch leaves with 2–5 papillae..... *3. heteropteroides.*
Leaves of secondary stems slenderly long-acuminate; leaf cells with 1–3 papillae. *4. Macounii.*

1. HETEROCLADIUM PROCURRENS (Mitt.) Rau & Hervey, Cat. 38. 1880.

Pterogonium procurrens Mitt. Journ. Linn. Soc. **8**: 37. *pl. 7.* 1865.
Heterocladium aberrans R. & C. Bot. Gaz. **15**: 59. 1890.

Plants rather stout for the genus, in spreading tufts, pale to yellowish green; stems 4–8 cm. long, stoloniform, pinnately branched; smaller branches simple, attenuate; larger branches often closely pinnate; central strand present; paraphyllia few, linear-lanceolate, serrate; stem leaves scariose, distant, spreading-recurved wet or dry, 1.4–1.8 x 0.6–0.9 mm., broadly triangular-ovate from an auriculo-cordate subclasping base, abruptly filiform-acuminate, acumination as long as base of leaf; costa thin, forking, the longer branch disappearing about or below the leaf middle; larger branch leaves similar, not auriculate, subdistichous, spreading, gradually acute to narrowly acuminate; margins crenate-serrate; costa longer and more strongly serrate at back, usually acute to narrowly acuminate; smaller branch leaves ovate-lanceolate, lower acute, upper sometimes obtuse; upper cells of very young branch leaves slightly papillose at back; cells of stem leaves smooth, clear, multiform, those of the median basal area linear, obtuse, ± 6 μ wide, 4–6 : 1, the others broader and shorter, varying from oblong-fusiform to oval-rhombic; apical cells linear; median cells of branch leaves broader and shorter. Setae about 2 cm. long; capsules reddish brown, oblong-ovoid, horizontal, curved and contracted under the mouth when dry and empty; urn 1.5–2 mm. long, about 2 : 1; operculum conic, apiculate; spores in February. Type locality British N. America, Drummond. Type in Mitten Herbarium at the New York Botanical Garden.

ILLUSTRATIONS:—Mitten, l. c.; Best, l. c. *pl. 13; Pl. 48.*
EXSICCATI:—R. & C. Musc. Am. Sept. 94 (as *H. aberrans*); Macoun, Can. Musci 498 & 690, also 484 & 692 (as *H. homoeopterum*); Grout, N. Am. Musci Pl. 75; Allen, Mosses Cascade Mts. 89; Holzinger and Blake, Plants of N. W. Montana 47.
On rocks, soil and occasionally on roots of trees. Montana, Idaho, Washington and British Columbia.
Dr. Best, whose monograph is followed in the main, says "spores in June," but Allen's 89 collected in Feb. has perfect capsules, while specimens collected in June are deoperculate. In some cases the leaves become erect-spreading when dried.

2. HETEROCLADIUM SQUARROSULUM (Voit) Lindb. Musc. Scand. 37. 1879.

Hypnum squarrosulum Voit in Sturm, Deutschl. Flora **2**: fasc. 11. 1810.
Hypnum dimorphum Brid. Sp. Musc. **2**: 149. 1812.

Plants more slender than the last, in thin spreading tufts, pale to deep green; primary stems 3–6 cm. long, with rudimentary central strand, stoloniform, irregularly divided and branched; secondary stems irregularly branched or occasionally almost regularly pinnate; paraphyllia multiform, few, roundish ovate to narrowly lanceolate, serrate; leaves of primary stems variable, the lower often rudimentary, the upper obscurely two-ranked, papillose, 0.7–1 x 0.5–0.7 mm., from a decurrent, cordate subclasping base broadly round-ovate, abruptly subfiliform acuminate, with upper part of leaf spreading-recurved; margins plane, crenulate-serrulate; costa usually short, thin, divided or double, sometimes obsolete, rarely reaching nearly to leaf middle; leaves of secondary stems loosely appressed-imbricate when dry, erect-spreading when moist, broadly ovate, serrulate, obtuse to short-acuminate; *ultimate branch leaves roundish ovate, rounded-obtuse to subacute;* leaf cells of the basal-central area of leaves of primary stems nearly smooth, clear, linear-oblong, about 6 μ wide, 3–6 : 1, in some cases this type of cell passes through the middle of the leaf into the acumination, in others they are surrounded above as well as on the sides by a broad border of shorter cells, varying from roundish quadrate to oval-oblong, *with a single (usually) subcentral papilla on both surfaces;* leaf cells of the branch leaves similar, those of the basal-central area shorter, the border cells sometimes hexagonal-quadrate. Seta about 1.5 cm. long; capsule constricted below the mouth when dry and empty, urn about 1.5 mm. long, about 2 : 1; operculum conic; spores in late winter or early spring. Type locality, Schweinfurt, Germany.

ILLUSTRATIONS:—Best l. c. *pl. 13; Pl. 48.*
EXSICCATI:—Macoun, Can. Musci 660 & 687 (as *dimorphum*); Grout, N. Am. Musci. Pl. 405, & 169 (as *Thuidium microphyllum*).

On rocks, soil and roots of trees from southern Vermont to Greenland, westward to Montana, Idaho, Washington and British Columbia. It has been reported from the vicinity of Amherst, Massachusetts in several lists but it is possible that all these records are based on Frost's report of a specimen from Brattleboro, Vermont in the Tuckerman and Frost List of plants growing in the vicinity of Amherst.

Dr. Best remarks in his monograph that this species varies considerably according to differences in habitat. When on rocks at high altitudes the tufts are more compact, the secondary stems and branches subjulaceous and the leaves more obtuse.

Var. COMPACTUM Mol. in sched., Pfeffer, Bryogr. Stud. *pl. 71.* 1869.

In dense grayish green tufts; primary stems stoloniferous with rudimentary leaves, not rarely defoliate; secondary stems ascending-erect, closely branched, branches short, obtuse, terete; leaves when dry appressed-imbricate, round-obtuse, nearly entire. Type locality, European.

On exposed rocks at high altitudes, Leiberg, Mosses from Kootenai Co., Idaho, no. 175, also Slocan City, British Columbia, Mrs. MacFadden.

3. HETEROCLADIUM HETEROPTEROIDES Best, l.c. 128.

Plants very slender, in intricate spreading tufts or mats, dark green; primary stems without central strand, creeping, stoloniferous, 3–6 cm. long, variously divided and irregularly branched; secondary stems ascending, irregularly branched to nearly regularly pinnate; all stems papillose; paraphyllia present, foliose to linear; leaves of creeping primary stems appressed-open, with reflexed or spreading apices, triangular-ovate from a subclasping cordate base, slenderly acuminate, 0.4–0.5 mm. long, papillose; margins plane, finely denticulate; costa thin, usually short and double; leaves of secondary stems, larger, more broadly ovate as a rule, more strongly costate and more strongly papillose, often as slenderly acuminate as figured for *H. Macounii;* ultimate branch leaves ovate, acute to narrowly acuminate; *cells of the basal-central area of stem leaves not so clearly differentiated as in the preceding species*, oblong to sublinear, ± 6 μ wide, 2–4 : 1, incrassate, those of the basal margins, rounded quadrate, passing into oval-oblong above, often broader than long, *each cell with 2–5 small bead-like papillae on each surface; apical cells of ultimate branch leaves quadrate to oblong, crowned with 2–4 papillae.* Setae about 1.5 cm. long; capsules ovoid, contracted under the mouth when dry and empty; urn 1.5 mm. long, 2 : 1; *operculum conic-rostrate*, nearly as long as the urn; spores in summer to autumn. Type locality, Washington. Type collected by J. A. Allen in the upper Nesqually Valley, Oct. 4, 1898.

ILLUSTRATIONS:—Best, l.c. *pl. 14: Pl. 47.*

EXSICCATI:—Macoun, Can. Musci 267 and 108 (as *H. heteropterum*).

On stones and ledges in damp places, Idaho, Oregon, Vancouver Id. & British Columbia.

Spores seem to be rarely produced. Distinguished from the closely related *H. heteropterum* by the apical cells of the ultimate branch leaves crowned with 2 or more papillae instead of one.

Var. FILESCENS Best, l. c.

Dark to yellowish green; primary stems creeping, 8–10 cm. long, sparingly branched; stems and branches filiform; leaves smaller, those of primary stems often almost scale-like. Type of variety collected W. B. Whittemeyer in the canyon of the Stilliquamish River, Washington, June, 1892. The variety seems even more common than the specific type and often associated with it and developed from it by habitat conditions. Grout, N. Am. Musci Pl. 69 merges into this variety.

EXSICCATI:—Macoun, Can. Musci 688 (as *H. heteropterum*); Grout, N. Am. Musci Pl. 250 & 473; Allen, Mosses Cascade Mts. 90a (as the species).

This variety strongly resembles *Tripterocladium* in gross appearance.

Most of the specimens in my herbarium seem intermediate between the species and variety.

H. heteropteroides and *H. procurrens* are often intermingled and *Hypnum occidentale* Sull. & Lesq. is often found with the former.

The costa in the species is often rather stout and reaches the leaf middle.

*4. HETEROCLADIUM MACOUNII Best, l. c. 127. *pl. 14.*

Scarcely more than a variety of the preceding from which it differs as follows: plants somewhat more robust throughout, leaves noticeably secund; stems and branches curved at the ends; all leaves more slender-pointed, especially the slenderly acuminate leaves of the secondary stems; papillae of the leaf cells rarely more than 3. Type locality, Vancouver Island; collected by John Macoun, June 2, 1893, and distributed

as *H. vancouveriense* Kindb., Can. Musci 638. Type in the herbarium of the New York Botanical Garden. *Pl. 47.*

Collected at several points on Vancouver Id. and at Cathlamet, Washington by A. S. Foster; Ashford, Washington, Allen.

5. HETEROCLADIUM HETEROPTERUM (Bruch.) Bry. Eur. fasc. 49–51, *pl. 480.* 1852.

Pterogonium heteropterum Bruch in Schwaegr. Suppl. 3[1]: *pl. 210b.* 1827.

A European species likely to be found in North America. It resembles the last but is easily distinguished by its non-secund leaves, non-papillose stems, and apical cells of ultimate branch leaves crowned with a single papilla. There are rarely, if ever, more than two papillae on one surface of a leaf cell. All known plants from N. America purporting to be this species have proved to be something else.

Subfamily LESKEAE.

Mostly slender plants, loosely to densely tufted; variously, but mainly irregularly, branched; central strand lacking or rudimentary; paraphyllia often present; leaves ovate to ovate-lanceolate, mostly papillose; costa strong (except in *Pterigynandrum*), usually reaching the leaf middle or beyond. Capsules erect and symmetric, or slighty inclined and somewhat curved; cilia of inner peristome short, rudimentary or wanting; operculum conic to short-rostrate.

5. *PSEUDOLESKEA Bryol. Eur. fasc. 49–51. 1852 (in part).

Lescuraea Bryol. Eur. fasc. 46–49. 1851.

Plants small to medium size, growing on rocks, stones, bases of trees, rarely on rotten wood or on the ground, generally in mountainous regions; stems radiculose, pinnately branched, central strand none or rudimentary; branches simple, usually recurved at tips; paraphyllia numerous, mostly linear-lanceolate; leaves papillose to smooth, entire to serrulate above, biplicate, ovate-lanceolate, acuminate, costate, margins often recurved; leaf cells quadrate-hexagonal to linear-rhomboidal; capsules erect or inclined, straight or curved, thick-walled, air spaces none, stomata few at the base and functionless; *exothecial cells usually quadrate;* exostome well developed, teeth confluent at the base into a colored basal band of the same texture; basal membrane ⅙ to ⅓ the length of the teeth; cilia usually poorly developed; calyptra cucullate.

KEY.

1.	Median cells of stem-leaves usually not much more than twice as long as wide	2.
	Median cells of stem-leaves three or four times as long as wide, or longer	5.
2.	Leaves papillose on both surfaces	*1. atrovirens.*
	Leaves smooth or papillose only on the upper surfaces	3.
3.	Leaves entire, smooth; paraphyllia rarely present	*4. arizonae.*
	Leaves often serrulate, papillose to almost smooth; paraphyllia present, sometimes few and small	4.
4.	Leaves long-acuminate	*2. oligoclada.*
	Leaves acute to short-acuminate	*3. pallida.*
5.	Many leaves with pale, slender hair-points	*8. Baileyi.*
	Leaves without such hair-points	6.
6.	Plants robust, often 6–10 cm. long, sparingly branched	*5. denudata.*
	Plants seldom more than 4 cm. long, more frequently branched	7.
7.	Costa percurrent in some of the leaves	8.
	Costa never more than subpercurrent	9.

* Grateful acknowledgment is made of the work of Dr. G. N. Best (Bull. Torr. Bot. Club **27**: 221–236. 1900, and Bull. Torr. Bot. Club **30**: 463–482. 1903), from whose monographs the writer has freely drawn in revising this and the following genus. Such corrections and additions as were necessary have been made. For assistance in various ways the author is also indebted to Dr. A. J. Grout, Newfane, Vt.; Mr. E. B. Bartram, Bushkill, Pa.; Mr. R. S. Williams, New York Botanical Garden; Mr. P. M. Hurlbert, National Museum of Canada, and Mr. C. L. Porter of the Rocky Mountain Herbarium, Laramie, Wyoming. *Aaron J. Sharp,* Univ. of Tennessee, Jan. 1934.

8. Leaves often strongly papillose; basal cells oblong ..... *7. atricha.*
   Leaves smooth or lightly papillose; basal cells oblong-linear ..... *10. frigida.*
9. Paraphyllia rarely present ..... *4. arizonae.*
   Paraphyllia always present ..... 10.
10. Leaf acumen short and broad; paraphyllia large and multiform ..... *6. radicosa.*
    Leaf acumen longer and narrower; paraphyllia small ..... *9. rigescens.*

1. PSEUDOLESKEA ATROVIRENS [Dicks.] Bryol. Eur. **5**: *pl. 477.* 1852.

Hypnum atrovirens Dicks. Pl. Crypt. fasc. 2. 10. 1790.
Leskea ? patens Lindb. Act. Soc. pro Fauna et Flora Fenn. 1880.
Pseudoleskea ticinensis Bott. Proc. Soc. Tosc. Sc. Nat. 1891.
Pseudoleskea atrovirens, var. *patens* (Lindb.) Hagen in sched. 1894.
Pseudoleskea heterocladioides Kindb. Rev. Bryol. **22**: 83. 1895.
Pseudoleskea tenella Kindb. Eur. & N. Am. Bryin. 50. 1896.

Plants loosely spreading, dark green above, reddish brown below; stems 3–5 cm. long, prostrate or slightly ascending, radiculose, branched sparingly below and irregularly pinnately above; branches simple, unequal, straight or curved; paraphyllia linear-lanceolate; stem leaves asymmetric, appressed-incurved when dry, erect-spreading when moist, the lower sometimes slightly recurved, entire or serrate above, gradually acute to somewhat abruptly acuminate from an ovate or oblong-ovate subdecurrent base, sharply and obliquely pointed, straight or subsecund, lightly biplicate, costate into the acumen, 0.8–1.2 mm. long, 0.4–0.6 mm. wide; margins recurved below and often at the base of the acumen; cells of the stem leaves *nearly isodiametric*, incrassate, chlorophyllose, *unipapillate on both surfaces;* papillae central, conic on the upper surface, round and flat on the lower; median cells quadrate-hexagonal, rarely more elongated, 7–9 μ wide; basal cells quadrate in several rows; apical cells oval-oblong; inner perichaetial bracts whitish, loosely erect, narrowly acuminate, lightly costate. Dioicous; seta reddish brown, smooth, 8–10 mm. long, slightly curved; capsule inclined to horizontal, broadly ovoid, asymmetric; exothecial cells roundish-quadrate, thick-walled; urn 1.5 mm. long, 0.8 mm. wide, constricted when empty and dry; teeth yellowish brown, margined, confluent into a purplish red basal band 5 lamellae wide; lamellae numerous, well developed; basal membrane yellowish, papillose, ¼–⅓ the length of the teeth; segments as long as the teeth, often slightly open on the keel; cilia one or two, poorly developed; annulus narrow; spores rough, 12–16 μ, maturing in spring. Type locality uncertain but probably Scotland.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club **27**: *pl. 7. figs. 1–7.* 1900; *Pl. 53.*
EXSICCATI:—Ren. & Card. Musc. Amer. Sept. 92; Husnot, Musc. Gall. 343.
On rocks, rarely on the bases of trees or the ground, Newfoundland and Labrador to British Columbia and southward to California, Idaho and New Hampshire.
In regard to European material, see Best's notes (Bull. Torr. Bot. Club **27**: 225, 226. 1900).

2. PSEUDOLESKEA OLIGOCLADA Kindb. Bull. Torr. Bot. Club **17**: 277. 1890.

Plants in rigid spreading tufts, yellowish green to reddish brown, usually with a glassy lustre; stems 3–6 cm. long, prostrate to slightly ascending, curved at the tips; branches few, unequal, subjulaceous, recurved; paraphyllia numerous, lanceolate; stem leaves close, appressed when dry, erect-spreading when moist, falcate-secund, biplicate, rather gradually narrowed into a long serrulate or entire acumen from an oblong-ovate subdecurrent base, 1.2–1.5 mm. long, 0.45–0.6 mm. wide; margins more or less recurved; costa very distinct, toothed on the lower surface, disappearing in the acumen; cells of stem-leaves *not uniform*, rather small and compact, with rounded-obtuse ends; median cells smooth on the lower surface, *lightly unipapillate on the upper, or often smooth on both*, oval-rhombic to linear-oblong, 6–8 μ wide, 2 to 3 times as long; basal cells quadrate-oblong to sublinear; alar transversely oval, becoming rounded-quadrate and extending well up the margins; apical small, oval to oval-oblong, branch leaves falcate, more distinctly serrulate, scarcely plicate; inner perichaetial bracts whitish, erect, long and narrowly subfiliform acuminate, distantly toothed or entire, lightly costate; cells long-linear, subflexuose. Dioicous; seta 9–11 mm. long, more or less curved; capsule oval-oblong, subsymmetric, reddish-brown, from almost erect to subcernuous; exothecial cells roundish oblong-quadrate; teeth reddish brown, joined at base into a band 5 joints wide; lamellae numerous, prominent; basal membrane yellowish, scarcely papillose, ¼–⅓ the length of the teeth; segments narrower than, but as long as, the teeth, open on the keel; cilia one or two, more or less developed;

annulus narrow, indistinct; operculum conical; spores roughened, 14–16 μ, maturing in spring. Type locality, Vancouver Island, collected by Prof. John Macoun, June 8, 1887.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club 27: *pl. 7. figs. 8–14, pl. 8. figs. 25–27.* 1900; *Pl. 53.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 472, 472a.
On rocks in the mountains, British Columbia to Colorado and Utah.
This species is to be distinguished from *P. atrovirens* by the longer acumen and polymorphous leaf cells which are at most only slightly papillose on the upper surface. It is more rigid and has smaller leaf cells than *P. radicosa.*

3. PSEUDOLESKEA PALLIDA Best, Bull. Torr. Bot. Club 27: 227, 228. *pl. 7. figs. 16–21.* 1900.

Plants in dense flattened tufts, pale olive-green above, ferrugineous below; primary stems prostrate, defoliate; secondary prostrate-ascending, 2–4 cm. long, sparingly branched above; branches straight or curved at tip, diverging very slightly; *paraphyllia few, small;* stem leaves asymmetric, deeply concave, biplicate, straight or slightly secund, gradually acute to abruptly short-acuminate from a roundish ovate base, often serrulate, 0.7–0.9 mm. long, 0.4–0.5 mm. wide; costa *weak*, subpercurrent; cells of stem leaves *scarcely papillose*, almost clear; basal cells short, rectangular; alar quadrate to transversely oval; median rhombic-oval to hexagonal-oblong, 7–9 μ wide, about twice as long; apical oval-oblong; perichaetial bracts erect, entire or serrulate, inner lightly costate. Dioicous; seta 8 mm. long, curved; capsule nearly symmetric, oval-oblong, inclined; urn 1.5 mm. long, .8 mm. wide; teeth yellowish, confluent at base into a reddish basal band 3–4 joints wide; basal membrane yellow, ¼ the length of the teeth; segments as long as the teeth, slightly open; cilia 2, *rudimentary;* spores *rough*, 13–16 μ. Type locality, Colorado; collected by T. S. Brandegee; type in herb. Columbia Univ.

ILLUSTRATIONS:—Best, l. c.; *Pl. 53.*
EXSICCATI:—Bauer, Musc. Eur. et Am. 2183.
Rare, in the mountains, Montana to Colorado.

Var. FILESCENS Best, l. c.

This differs from the type in having filiform secondary stems with few or no branches, leaves narrower (0.3–0.4 mm. by 0.6–0.8 mm.), with longer and narrower cells, and perichaetial bracts almost ecostate.
Type locality, Colorado; collected by T. S. Brandegee.

4. PSEUDOLESKEA ARIZONAE R. S. Williams, Bryologist 33: 20. *pl. 3.* 1930.

Pseudoleskea integrifolia Dixon & Bartram in litt.

Plants small, in flattened tufts, pale to olive-green above, brownish below; stems slender, procumbent, 2–3 cm. long, irregularly branched, with a rather distinct rudimentary strand; *paraphyllia rare;* stem leaves *entire*, rather broadly ovate-acute, reflexed on the margin often from near apex to base, about 0.3 mm. wide and 0.6 mm. long; costa *stout*, prominent, smooth on the back, ¾ the length of the leaf; *leaf cells smooth*, irregular, mostly elongate; median often rhombic, 2–4 μ wide, 5–10 μ long; alar quadrate to transversely elongated, in 2–3 rows; perichaetial bracts pale, *entire*, *plicate*, *mostly costate*, up to 1.4 mm. long. Dioicous; seta red, smooth, at least 1 cm. long; capsule slightly curved-ovate, inclined; urn 1 mm. long, 0.5 mm. wide; teeth hyaline-bordered, finely cross-striate below, papillose above, confluent at base; basal membrane ⅓–½ the length of the teeth, papillose; segments nearly as long as the teeth, narrowly lanceolate, finely papillose, often slightly open on the keel; cilia one or two, *nearly as long as the segments*, slender, papillose; annulus frequently broad and well developed; operculum conical-acute; spores smooth or slightly granulose, 11–15 μ. Type locality, Monument Peak, Chiricahua Mts., Ariz.; collected by J. C. Bloomer, Oct. 2, 1908; type in herb. N. Y. Botanical Garden.

ILLUSTRATIONS:—Williams, l. c.; *Pl. 55.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 412 (as *P. pallida*); Bartram, Mosses of S. Ariz. 35, 359, 390A, 396, 403B and 406.
Rather common in the mountains of the arid southwest.
While this species is clearly allied to *P. pallida* and particularly to *P. oligoclada*, it is distinct from both in the entire leaf margin, the smooth costa, the scarcity of paraphyllia and the well-developed cilia of the inner peristome.

5. Pseudoleskea denudata Kindb. Eur. & N. Am. Bryin. 52. 1897.

Pseudoleskea sciuroides, var. *denudata* Kindb.; Macoun, Cat. Can. Plants **6**: 181. 1892.
? Ptychodium oligocladum Limpr. Die Laubm. **2**: 801. 1895.

Plants in loose spreading tufts, pale yellow-green above, brownish to dirty white below; stems *with very few branches*, not radiculose, prostrate, serpentine, *6–10 cm. long*, defoliate below; stems and branches hooked at tips; *paraphyllia multiform*, mostly long and narrowly linear lanceolate; upper stem leaves appressed when dry, erect-spreading when moist, concave, more or less falcate-secund, lightly plicate; ovate-lanceolate from a decurrent base, acuminate, narrowly and obliquely pointed, entire or serrulate above, *1.9–2.2 mm. long, 0.7–0.9 mm. wide;* margins broadly recurved to apex; costa narrow, yellowish, subpercurrent; cells of stem leaves yellowish at base, smooth, clear; median cells sublinear, flexuose, 5–7 μ wide, 4–6 times as long; basal oblong-rectangular; alar quadrate-oblong; apical linear; branch leaves much smaller, distinctly serrulate above. Dioicous; sporophyte unknown. Type locality, Asulcan Creek, Selkirk Mts., Canada, collected by J. Macoun, Aug. 7, 1890; type duplicate in herb. Can. Geol. Survey.

Illustrations:—Best, Bull. Torr. Bot. Club **27**: *pl. 7. figs. 22–27.* 1900; *Pl. 53.*
Exsiccati:—Grout, N. Am. Musc. Pl. 455.
Rarely collected; on soil and rocks, British Columbia.
This is one of the largest known species of *Pseudoleskea* and both it and the following variety may be recognized by their size and freedom from radicles. The sporophyte of the species probably resembles that of the following variety. Concerning the latter, the well-developed cilia are of interest.

Var. Holzingeri Best, Bull. Torr. Bot. Club **27**: 229. *pl. 8. figs. 28 & 29.* 1900.

The gametophyte differs from the type in its shorter and diffusely branched stems with leaves slightly smaller and more strongly falcate-secund; perichaetial bracts small, thin, broadly ovate-oblong, abruptly and narrowly acuminate, serrulate above, tips spreading-recurved, inner subvaginate, costate; seta reddish brown, slightly curved, flattened and twisted above, 10–12 mm. long; capsules broadly oblong-oval, asymmetric, inclined, strongly contracted when dry and empty; urn 1.5–2 mm. long, 1 mm. wide; exothecial cells thick-walled; teeth reddish brown, strongly lamellate, confluent into a purplish red basal band 4 joints wide; basal membrane yellow, papillose, ¼–⅓ the length of the teeth; segments as long as the teeth, carinate, open; cilia 1–3, *rather well developed*, papillose; annulus narrow; operculum short-conic; spores rough, 16–20 μ, maturing in spring.

Illustrations:—Best, l. c.; *Pl. 53.*
Exsiccati:—Allen, Mosses of the Cascade Mts. 95; Bauer, Musc. Eur. et Am. 2181 & 2182.
Rather more common and more widely distributed than the type. On soil and rocks, British Columbia, Montana, Hudson Straits. This variety can be separated from *P. radicosa* by its larger size, longer leaf cells and its lack of radicles.

6. Pseudoleskea radicosa (Mitt.) Lesq. & James, Man. of N. A. Mosses. 320. 1884.

Hypnum radicosum Mitt. Jour. Linn. Soc. **8**: 31. 1864.
Macounia sciuroides Kindb. Enum. Bryin. Exot. 1888.
Pseudoleskea sciuroides Kindb. Bull. Torr. Bot. Club **17**: 276. 1890.
Hypnum congestum Wils. Ms.
Hypnum congestum Hook. & Wils. in Drumm. Musci Am. 225, in part.

Plants in soft tufts, yellow-green to dark green; stems 3–5 cm. long, rather densely radiculose, irregularly branched; branches usually recurved, simple; *paraphyllia numerous, multiform;* stem leaves loosely appressed when dry, spreading when moist, 1.2–1.6 mm. long, 0.35–0.5 mm. wide, secund, subdecurrent, biplicate, from an ovate to oval-oblong base gradually or abruptly contracted to a narrow, oblique, serrulate or entire acumen; margins recurved to base of acumen; costa stout, usually toothed, disappearing in the acumen; cells of stem leaves somewhat loose, *often smooth on both surfaces*, occasionally lightly papillose on the upper; *basal cells oblong-quadrate*, in several rows; median oval-oblong to linear-rhomboidal, 8–10 μ wide, 2–4 times as long; alar cells quadrate; apical linear; branch leaves falcate-secund, serrate; perichaetial bracts erect, thin, whitish, finely acuminate, inner subvaginate, lightly costate. Dioicous; pedicels 9–12 mm. long, curved; capsules oval to obovate-oblong, *asymmetric, inclined to subpendent*, elongated, contracted and arcuate when dry; *urn 1.3–1.9 mm. long, 0.7–0.9 mm. wide;* exothecial cells thick-walled; teeth reddish margined, confluent into a purplish red basal band 5 joints wide; basal membrane yellow, finely papillose,

1/5–1/4 the length of the teeth; *segments oblong-lanceolate*, carinate, somewhat open, about as long as the teeth; cilia rudimentary; annulus narrow, indistinct; operculum conic, sometimes short beaked; spores rough, 14–18 μ, maturing in spring and early summer. Type locality, North America.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club **27**: *pl. 8. figs. 1–9, 30, 31.* 1900; *Pl. 54.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 399 (as *P. atrovirens*) & 466; Allen, Mosses of the Cascade Mts. 96.
On various substrata, Labrador and New Hampshire to British Columbia and Idaho.

Var. COMPACTA Best, Bull. Torr. Bot. Club **27**: 231. 1900.

This variety differs from the usual form in the darker color; the shorter, smaller stems; the short, turgid branches; the often straight stem leaves and the shorter, broader median leaf cells. In the Northwest; less common than the type.

7. PSEUDOLESKEA ATRICHA Kindb. Eur. & N. Am. Bry. 53. 1897.

Pseudoleskea atrovirens var. *atricha* Kindb.; Macoun, Cat. Can. Pl. **6**: 180. 1892.

Plants in yellow-green to olive-green mats, stems 2–4 cm. long, prostrate, irregularly branched; branches many, unequal, often curved at the tip; paraphyllia few, lanceolate to linear; stem leaves appressed when dry, erect-spreading when moist, concave, biplicate, often slightly secund, ovate-lanceolate from a more or less decurrent base, abruptly to gradually acuminate, serrulate above, *papillose on both surfaces above*, 0.8–1 mm. long, 0.25–0.35 mm. wide; margins often recurved nearly to apex; costa stout, subpercurrent to percurrent, toothed on the back; cells of stem leaves clear, not uniform; *basal cells oblong;* alar quadrate, thick-walled, extending up the margin; *median cells rhomboidal-hexagonal to sublinear, with thin, pitted walls*, averaging 26 μ long, 7 μ wide; cells of the acumen oblong-hexagonal; apical long-oval to sublinear; perichaetial bracts lanceolate, narrowly acuminate, with sublinear cells; inner subvaginate, thinly costate. Dioicous; sporophyte unknown. Type locality, Griffin Lake, British Columbia; collected by J. Macoun, Aug. 12, 1889.

EXSICCATI:—Grout, N. Am. Musc. Pl. 336.
Rarely collected; on rocks and the trunks of trees, British Columbia and Washington.
P. atricha is puzzling in that it has the aspects of several species without wholly fitting any. Macroscopically, it has the appearance of *P. rigescens*. In being papillose and exhibiting pitted cell walls, it is similar to *P. Baileyi*, but there the similarity stops. The long, stout costa and long, thin-walled median cells are somewhat similar to *P. frigida*, but the oblong basal cells, the large papillae and broad acumen with shorter cells clearly distinguish it from that species. It can be separated from *P. radicosa* by smaller, narrower leaves; the slender median cells of leaves, with pitted, thin walls; the longer costa and the larger papillae of the acumen.

8. PSEUDOLESKEA BAILEYI Best & Grout, N. Am. Musc. Pl. 474. 1917.

Plants *large*, in loose tufts, yellow-green to olive-green above, blackish below; stems 3–6 cm. long, not radiculose, irregularly branching; branches curved, usually simple; paraphyllia none; stem leaves loosely appressed when dry, spreading when moist, occasionally recurved at tip, slightly secund, subdecurrent, biplicate below, 2 mm. long, about 0.6 mm. wide, ovate, *mostly attenuate into a pale, short hair-point;* margins recurved below, serrulate near the apex; costa 3/4 the length of the leaf, often scabrous at the back above; *leaf cells papillose, on both surfaces*, particularly above; basal cells near the costa *elongated with irregularly thickened* walls, near the margin often quadrate; median cells silghtly oblique, 12–16 μ long, about 8 μ wide, with unequally thickened walls; apical slender, irregular; perichaetial leaves entire or nearly so, inner oblong-lanceolate, about 2.5 mm. long, outer much shorter. Dioicous; seta 9–11 mm. long; capsule oblong, almost erect to inclined; urn 1.5 mm. long, 1 mm. wide; teeth confluent at the base, reddish below, paler and papillose near the apex; basal membrane 1/3 the height of the teeth; segments narrow, as long as the teeth, carinate, open; *cilia none; annulus none;* operculum short conic, slightly apiculate; spores rough, up to 20 μ in diameter. Type locality, Sunset Trail, Cascade Summit, Washington. Collected by J. W. Bailey, July 19, 1916.

ILLUSTRATIONS:—Williams, Bryol. **27**: *pl. 13.* 1924; *Pl. 55.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 474.
Known only from Washington. Easily recognized by its size, filiform leaf tips, and the extraordinary, irregularly-thickened walls of the leaf cells.

9. PSEUDOLESKEA RIGESCENS (Wils.) Lindb. Act. Soc. Fenn. **10**: 277. 1872.

Leskea rigescens Wils. Ms. Drumm. Musc. Am. 225. in part.
Lescuraea radicosa var. *gracilis* Lesq. & James, Man. N. A. Mosses, 320. 1884.
Pseudoleskea stenophylla Ren. & Card. Bot. Centralbl. **44**: 421. 1890.
Lescuraea imperfecta C. M. & Kindb.; Macoun, Cat. Can. Pl. **6**: 170. 1892.
Lescuraea stenophylla Kindb. Eur. & N. Am. Bryin. 26. 1897.

Plants in soft intricate mats, yellow-green; stems 2–4 cm. long, radiculose, irregularly branched; branches unequal, slender, curved; paraphyllia small, linear-lanceolate; stem leaves loosely appressed when dry, erect-spreading when moist, 0.8–1.2 mm. long, 0.25–0.35 mm. wide, lanceolate or ovate-lanceolate, *gradually long and narrowly acuminate*, entire or serrulate above, lightly biplicate; costa thin, disappearing in the acumen; margins plane or revolute below; cells of stem leaves smooth or lightly papillose on the upper surface, rarely on both; basal cells oblong-quadrate in several rows; alar quadrate, extending well up the margins; median sublinear-rhomboidal, 7–8 μ wide, 2–4 times as long; apical oval to sublinear; branch leaves narrower, serrulate above; perichaetial bracts long-lanceolate, narrowly acuminate, thin, erect, whitish, inner subvaginate, scarcely costate. Dioicous; seta erect or slightly curved above, 6–8 mm. long; *capsule small*, oval-oblong, *usually erect and symmetric; urn 1 mm. long, 0.7 mm. wide;* teeth yellow-red, confluent at base into a dark red band 3 joints wide; basal membrane pale yellow, about $\frac{1}{6}$ the length of the teeth; *segments linear*, nearly as long as the teeth, concave; cilia none; annulus none; spores rough, 14–18 μ, maturing in spring. Type locality, North America.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club **27**: *pl. 8. figs. 10–16, 32, 33.* 1900; *Pl. 54.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 94; Allen, Mosses of the Cascade Mts. 94.
On various substrata in the mountains of the northwest: British Columbia to Idaho.
Some sterile forms of this species cannot be satisfactorily distinguished from *P. radicosa.* When fertile, they are easily distinguished by the smaller, suberect capsules with linear peristome segments found on *P. rigescens.*

Var. HOWEI Best, Bull. Torr. Bot. Club **27**: 233. 1900.

This differs from the type in exhibiting strongly recurved stems and branches; secund, serrate, slightly smaller stem leaves with narrowly recurved margins; stouter costa; more compact areolation; and numerous quadrate basal and alar cells which fill $\frac{1}{3}$ of the leaf. Type locality, Mt. Shasta, Calif., collected by Dr. M. A. Howe, Aug. 5, 1894.

EXSICCATI:—Grout, N. Am. Musc. Pl. 337.

10. PSEUDOLESKEA FRIGIDA (Kindb.) Sharp, **comb. nov.**

Lescuraea frigida Kindb. Eur. & N. Am. Bryin. 26. 1897.
Pseudoleskea substriata Best, Bull. Torr. Bot. Club **27**: 233, 234. *pl. 8. figs. 17–24.* 1900.

Plants in flattened tufts, yellowish-green to golden-green; stems radiculose, 2–5 cm. long, often pinnately branched; branches suberect, usually simple; paraphyllia few, multiform; stem leaves appressed when dry, erect-spreading when moist, 0.8–1 mm. long, 0.3–0.4 mm. wide, straight, deeply biplicate, oval-oblong, gradually acute or acuminate, sometimes wholly smooth, often somewhat papillose on both sides in the upper part; margins strongly recurved nearly to apex, serrate above; *costa subpercurrent to percurrent*, toothed on the back; cells of the stem leaves clear, rather thin-walled; basal cells *oblong-linear* in 2 or 3 rows; alar quadrate, thick-walled, filling the region between the margins and folds, extending upwards and becoming oblong; median cells sublinear, 6 μ wide, 4–6 times as long, *thin-walled;* apical linear. Dioicous; sporophyte unknown. Type locality, Labrador; collected by J. Macoun, 1896.

ILLUSTRATIONS:—Best, l. c.; *Pl. 54.*
Rarely collected; on rocks, Labrador, Vermont, British Columbia, and Lake Lindeman, Northwest Territory.
Best states that the leaves are smooth, but nearly every plant exhibits some leaves which are clearly lightly papillose in the acumen. This, together with its smaller size and shorter, more serrate acumination of the leaves, serves to distinguish *P. frigida* from the European *P. striata* (Schwaegr.) Dixon, to which it is very closely related.

*6. LESKEA Hedw. Sp. Musc. 211. 1801.

Plants small to medium-sized, growing in mats or tufts. Stems prostrate, radiculose, pinnately to fasciculately branched, seldom stoloniferous; central strand either small, rudimentary, or none; paraphyllia sometimes present; leaves usually papillose, ovate to ovate-lanceolate, acute, acuminate or obtuse, usually unicostate, sometimes shortly bicostate, usually entire; leaf cells more or less uniform, median quadrate-hexagonal to oval-oblong; pedicels smooth; capsules usually straight and erect, oval to subcylindric, annulate; *exothecial cells oblong;* teeth lanceolate-linear, divisural line and lamellae usually present; basal membrane narrow; segments linear, often keeled and cleft; cilia, if present, rudimentary; opercula mammillate to long-conic; calyptra cucullate, smooth.

KEY.

1. Median cells of leaves isodiametric; peristomial teeth incurved when dry	2.
Median cells of leaves longer than wide; peristomial teeth straight when dry	6.
2. Leaves averaging less than 0.6 mm. in length; costa rough below; median leaf cells 5–7 μ wide	*5. australis.*
Leaves averaging more than 0.7 mm. in length; costa smooth; median leaf cells 7–10 μ wide	3.
3. Leaves more than twice as long as wide	4.
Leaves less than twice as long as wide	5.
4. Capsules straight; operculum short-conic	*1. polycarpa.*
Capsules curved; operculum long-conic	*2. arenicola.*
5. Leaves symmetric, biplicate; margins often revolute	*3. gracilescens.*
Leaves asymmetric, not plicate; margins plane	*4. obscura.*
6. Costa extending well into the acumen	*6. nervosa.*
Costa barely reaching the acumen or shorter	7.
7. Some of the median cells of the leaves 3–5 : 1; margins sometimes serrulate above	*7. Williamsi.*
None of the median cells of the leaves over 3 : 1; margins entire	8.
8. Leaves with papillae very rare or wanting	*8. tectorum.*
Leaves with low papillae	*9. cyrtophylla.*

1. LESKEA POLYCARPA [Ehrhart] Hedw. Sp. Musc. 225. 1801.

Leskea polycarpa Ehrh. Dec. Crypt. n. 96. 1788.
Hypnum multiflorum P. B. Prodr. 66. 1805.
Hypnum polycarpum C. M. Syn. **2**: 469 and 690. 1851.
Leskea paludosa var. *polycarpa* Hartm. Skand. Fl. (Ed. 5) 337. 1849.

Plants in loose mats, pale green, sometimes dirty dark- to yellowish-green or reddish brown; stems 2–4 cm. long, subpinnately branched; *central strand small but distinct;* paraphyllia few, linear-lanceolate; stem-leaves loosely appressed when dry, erect-spreading when moist, 0.8–1.2 mm. long, 0.35–0.45 mm. wide, from a subcordate, slightly decurrent, ovate to oblong-ovate base, *lanceolate,* gradually acute to abruptly acuminate, more or less secund and obliquely pointed, biplicate, entire, usually recurved on one or both basal margins, costa disappearing below apex; branch-leaves smaller, often obtuse or blunt-pointed; median cells of stem leaves roundish quadrate-hexagonal, 7–8 μ wide, with one or two small papillae on each surface; basal quadrate-oblong; alar quadrate or transversely oval. Monoicous; perichaetal bracts erect, oblong-lanceolate, plicate-striate, *lightly costate;* pedicel about 1 cm. long, flexuose, capsule erect, *straight or slightly curved,* subcylindric, tapering at the base, yellowish or reddish brown at maturity, wrinkled and contracted below the mouth when dry; urn about 2 mm. long, 7 mm. wide; teeth yellowish, linear-lanceolate, lamellate, *divisural line distinct; basal membrane about ⅕–¼ the length of the teeth;* segments linear, scarcely open on the keel, equaling the teeth in length; cilia rudimentary or none; annulus of 2 rows of cells; *operculum conic;* spores usually smooth, 9–12 μ, maturing in early summer. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl. 470;* Husnot, Musc. Gal. *pl. 85;* Dixon & Jameson, Handbook, *pl. 50;* Braithwaite, Brit. Moss Flora **3**: *pl. 86;* Limpricht, Laubm., *f. 343;* Broth., Eng.-Prantl, Pflanzenfam. (Ed. 2) **11**: 301. *fig. 651.* 1925; M. H. M. *pl. 56.*

*See footnote page 185.

Exsiccati:—Drumm. Musc. Amer. 223 (as *Hypnum medium* Dicks.).
On the base of trees, rotten wood, rarely on stones or the ground, Newfoundland to the Rocky Mountains, southward to the central states.

Leskea polycarpa var. paludosa (Hedw.) Schimp. Syn. 486. 1860.

Leskea paludosa Hedw. Descr. **4**: 115. 1797; Sp. Musc. 221. 1801.
Hypnum inundatum Dicks. Crypt. **4**: 17. 1801.
Leskea palustris Hedw. Descr. **4**: 1. *pl. 1.* 1793.
Leskea subobtusifolia C. M. & Kindb.; Macoun, Cat. Can. Pl. **6**: 169. 1892.
Leskea polycarpa var. *subobtusifolia* (C. M. & Kindb.) Best, Bull. Torr. Bot. Club, **30**: 466. 1903.

A variety which often cannot be distinguished readily from the species, but is generally more robust, more diffusely branched, with longer stems and branches somewhat curved at the tips. Capsules often somewhat longer.

Illustrations:—Hedw. l. c.
Exsiccati:—Grout, N. Am. Musc. Pl. 233, 296, and 343.
In more moist places than the species, sometimes submerged, about the base of trees and on rotten wood, rarely on stones. New England, Minnesota and North Dakota to British Columbia and Oregon.

2. Leskea arenicola Best, Bull. Torr. Bot. Club, **30**: 467. *pl. 15, figs. 1–13.* 1903.

Plants somewhat rigid, in loosely spreading tufts, pale yellowish-green to reddish-brown; stems 2–5 cm. long, pinnately branched; branches simple, ascending, sometimes curved, *central strand small, distinct;* paraphyllia mostly linear-lanceolate; stem-leaves rigid, secund, 0.4–0.5 mm. wide, 0.8–1 mm. long, *ovate to ovate-lanceolate*, obliquely acuminate, acute to blunt-pointed, scarcely biplicate, margins usually recurved at base, entire or sinuate-serrulate above, costa disappearing in the acumen; leaf cells stoutly unipapillate except for the generally smooth upper alar surface; alar quadrate; median oval-rhombic to oblong-fusiform, 7–9 μ wide, nearly twice as long, branch-leaves about ⅓ smaller and scarcely secund. Monoicous; perichaetial bracts appressed, plicate, *costate*, long and narrowly acuminate; pedicel 1.5 cm. long, grooved, curved, reddish; capsule oblong-cylindric, *curved*, tapering at the base wrinkled when dry; urn about 2 mm. long, 0.6 mm. wide; teeth lanceolate-linear, yellowish below, pale above, densely papillose, *divisural line faint*, ventral surface strongly lamellate; basal membrane yellowish, papillose, *about 1/7 the length of the teeth;* segments as long as the teeth, split, open on the keel; cilia rudimentary; annulus broad, 2 or 3 rows of cells; operculum whitish, subshining, *long conic*, nearly one half the length of the urn; spores smooth, 10–13 μ, maturing in early summer. Type locality Smyrna, Delaware.

Illustrations:—Best l. c.; M. H. M. *pl. 57, figs. 1–13.*
Exsiccati:—S. & L. Musc. Bor. Am. 243 and 365 as *L. obscura;* Ren. & Card. Musc. Am. Sept. 192b as *L. polycarpa forma;* Grout, N. Am. Musc. Pl. 147 and 212.
On the base of trees, rarely on rotten wood, in sandy places. New England to Virginia, westward to Minnesota and North Dakota.

3. Leskea gracilescens Hedw. Spec. Musc. 222. *pl. 56, figs. 8–13.* 1801.

Hypnum gracilescens P. B. Prodr. 64. 1805.
Leskea intermedia Best, Bull. Torr. Bot. Club, **30**: 469. 1903.

Plants in intricate spreading tufts, various shades of green to reddish-brown or blackish; stems 2–4 cm. long, pinnately branched; *central strand rudimentary or none;* branches simple, erect, often subjulaceous; paraphyllia few, rarely none, lanceolate; stem-leaves appressed-imbricated when dry, erect-spreading when moist, 0.4–0.5 mm. wide, 0.65–0.9 mm. long, ovate, gradually acute, obtuse or blunt-pointed, straight, *lightly biplicate, symmetric,* margins entire, *often more or less revolute,* costa subpercurrent; branch-leaves similar, not plicate; leaf cells somewhat uniform, *unipapillate on lower surface, usually smooth on upper;* median quadrate-hexagonal, 8–10 μ broad; alar and basal quadrate, apical roundish. Monoicous; perichaetial bracts erect, striate, blunt, costate; pedicel 8–10 mm. long; capsule erect, oblong-cylindric, tapering at base, substriate and reddish when empty; annulus of 2 rows of cells, deciduous; teeth *whitish*, linear-lanceolate, lamellate, *divisural line faint; basal membrane ¼ the length of the teeth;* segments linear, usually shorter than the teeth, carinate, open, sometimes poorly developed and unequal; cilia none; operculum conic, obtuse or acute; *spores 8–11 μ*, smooth, maturing in early summer. Type locality, Pennsylvania.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. *pl. 77* probably; *Pl. 71.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 117 & 211.
On the base of trees, rotten wood, stones, and the ground. Common in northeastern U. S. to the Rocky Mountains, rare in Canada and the south, absent on the Pacific Coast.

4. LESKEA OBSCURA Hedw. Spec. Musc. 223. *pl. 57. figs. 1–9.* 1801.

Leskea obtusa R. & C. Bot. Gaz. **17**: 296. 1892.
Leskea ? Cardoti Kindb. Rev. Bryol. **22**: 83. 1895.

Plants in loose spreading tufts, rarely in mats, deep green to dark olive-green, older parts reddish brown; stems 3–5 cm. long, sparingly branched; *central strand small, distinct;* paraphyllia few, lanceolate, or none; branches short, tumid, or elongated and slender; stem-leaves incurved-appressed when dry, patulous when moist, oblong-ovate, 0.4–0.6 mm. wide, 0.8–1.3 mm. long, straight or slightly curved, *thickish*, concave, subcarinate, *scarcely plicate, asymmetric, margins plane*, apex rounded-obtuse to subacute, entire or serrulate, costa disappearing below apex; branch leaves similar, more symmetric, sometimes short-acuminate; leaf cells somewhat uniform, *pluripapillate on the lower surface with small papillae, papillose or nearly smooth on the upper;* median cells quadrate-hexagonal, 8–10 μ wide; basal quadrate-oblong, apical smaller, isodiametric. Monoicous; perichaetial bracts erect, appressed, costate, blunt-pointed; pedicel reddish, 1–1.5 cm. long; capsule erect, straight, oblong-cylindric, thin-walled, yellowish, wrinkled and slightly contracted below the mouth when dry; urn 1.75–2.25 mm. long, 0.8 mm. wide; teeth linear-lanceolate, *yellowish*, papillose, lamellate, *divisural line distinct below, faint above;* basal membrane yellowish, *about ⅕ the length of the teeth;* segments linear, densely papillose, more or less open, shorter than the teeth; annulus of 2 rows of cells; operculum short-conic, obtuse or apiculate; *spores 11–14 μ*, smooth, maturing in early summer. Type locality, Pennsylvania.

ILLUSTRATIONS:—Card. Bull. Herb. Boiss. **7**: *pl. 9. fig. 4;* Best, Bull. Torr. Bot. Club, **30**: *pl. 15. figs. 14–27;* Jennings, Mosses W. Pa. *pl. 35;* M. H. M. *pl. 57. figs. 14–27.*
EXSICCATI:—Drumm. Musc. Amer. 105; Aust. Musc. Appal. 270; R. & C. Musc. Am. Sept. 193; Grout, N. Am. Musc. Pl. 331.
On the base of trees or rotten wood; less frequently on stones or moist soil. Widely distributed east of the Rocky Mountains.
In addition to the points emphasized above, *L. obscura* generally has a larger sporophyte than *L. gracilescens.*

5. LESKEA AUSTRALIS Sharp, **nom. nov.**

Leskea microcarpa Schimp., Sull. Musc. & Hepat. of the U. S. 59. 1856. (Not of Brid. 1827.)

Plants smallest of the genus, in thin spreading tufts, yellowish green to dark green; *stems 1–3 cm. long*, subpinnately branched; *central strand minute or none;* paraphyllia few, small, lanceolate; stem-leaves somewhat rigid, appressed when dry, spreading when moist, 0.25–0.4 mm. wide, 0.4–0.6 mm. long, ovate, subcordate, more or less narrowly long-acuminate, entire, basal margins revolute, costa subpercurrent, *rough below;* branch leaves smaller, acute to narrowly acuminate; leaf cells *small, angular*, papillose on the lower surface, usually smooth on the upper; median cells quadrate-hexagonal, *irregular, often* indistinct, *5–7 μ wide;* alar oval-quadrate in about 6 rows. *Monoicous;* perichaetial bracts somewhat loose, erect or spreading at tips, long and narrowly acuminate, *costate;* pedicel erect, *5–7 mm. high;* capsule erect, oval-oblong, reddish-brown, shining; urn about 1.5 mm. long and 0.6 mm. wide; teeth fragile, *whitish*, papillose, linear-lanceolate, 0.25 mm. long, confluent at the slightly broadened base, not markedly bulging when dry, divisural line faint or none; basal membrane thin, whitish, about ¼ the length of the teeth; segments short, often rudimentary; annulus narrow, 1 or 2 rows of cells; operculum conic, short-beaked; *spores slightly roughened*, 9–13 μ, *maturing in spring.* Type locality, Alabama.

ILLUSTRATIONS:—Best, Bull. Torr. Bot. Club, **30**: *pl. 15. figs 28–40.* 1903; *Pl. 52.*
EXSICCATI:—Drumm. Musc. Amer. (South. States) 89 (as *L. nervosa*); Sull. Musc. Allegh. 69 (as *L. nervosa*); Ren. & Card. Musc. Am. Sept. *194* (as *L. gracilescens*); Langlois, Fl. Ludov. 246, Grout, N. Am. Musc. Pl. 375.
On roots of trees, rotten wood, rarely on the ground. In the Gulf States: Florida to Texas.

6. LESKEA NERVOSA (Schwaegr.) Myrin, Coroll. Fl. Upsal. 52. 1834.

Pterogonium nervosum Schwaegr. Suppl. **1**[1]: 102. 1811.
Leskea bulbifera Froehl.; Brid. Sp. Musc. **2**: 61. 1812.

Anomodon rigidulus Kindb. Laubm. Schwed. u. Norw. 11. 1883.
Amblystegium montanae Bryhn, Bryol. 5: 26. 1902.
Leskea montanae (Bryhn) Grout, Moss Flora 3^2: 75. 1931.

Plants in thin appressed tufts, pale to dark green, becoming brown or black with age; stems 4–7 cm. long, *without paraphyllia*, pinnately branched; branches simple, ascending, sometimes branched; *central strand small, distinct;* stem leaves broadly ovate, subcordate, slightly decurrent, *abruptly long-acuminate*, 0.35–0.5 mm. wide, 0.8–1.3 mm. long; *acumen narrowly lanceolate-linear*, more or less recurved, margins plane, subsinuate; body concave, biplicate, margins sometimes recurved on one or both sides; costa subpercurrent, narrow, scarcely tapering; branch leaves smaller, narrow, erect-spreading; leaf cells smooth or scarcely papillose; median cells oval-hexagonal to oval-oblong, 7–9 μ x 8–12 μ; alar quadrate to transversely oval in 5 or 6 rows, extending well up the margins and becoming isodiametric. *Dioicous;* perichaetial bracts long and narrowly acuminate, *slightly costate*, inner erect; *pedicel 10–12 mm. long;* capsule erect, subcylindric, brownish, wrinkled when dry; urn 2.2 mm. long, 0.7 mm. wide; teeth erect, confluent at base, linear-lanceolate, *yellowish*, margined, dorsal surface finely striate, divisural line zigzag, ventrally lamellate, basal membrane narrow, about ¼ the length of the teeth; segments irregular, unequal, sometimes rudimentary; annulus of 2 rows of cells, deciduous in fragments; operculum conic, *obliquely short-beaked;* calyptra reaching the base of the capsules; *spores roughened*, 12–15 μ, *maturing in summer.* Type locality, Germany.

Illustrations:—Bry. Eur. *pl. 472;* Husn. Musc. Gall. *pl. 86;* Best, Bull. Torr. Bot. Club, **30**: *pl. 16. figs. 41–54;* Jennings, Mosses W. Pa. *pl. 35;* Broth., Eng.-Prantl, Pflanzenfam. (Ed. 2) **11**: *fig. 652.* 1925; M. H. M. *pl. 57. figs. 41–54.*

Exsiccati:—Aust. Musc. Appalach. 271; Grout, N. Am. Musc. Pl. 133, 175 & 217.

On the base of trees, rarely on rotten wood or stones, Labrador to British Columbia, south to Pennsylvania and Colorado. Usually sterile in the southern part of its range, more frequently fertile northward.

Fertile plants collected at Smuggler's Notch, Vt., by C. G. Pringle differ little from European material of this species, but show distinct lamellae on the teeth. In the writer's opinion, this is sufficient to keep it in the genus *Leskea.*

Husnot's figures show a much longer costa than is present in the most of the American material.

Var. nigrescens (Kindb.) Best, Bull. Torr. Bot. Club, **30**: 474. 1903.

Leskea nigrescens Kindb. Bull. Torr. Bot. Club, **16**: 97. 1889.
Leskea nervosa var. *flagellifera* Kindb. Ottawa Nat. **4**: 62. 1890.
Anomodon heteroideus Kindb.; Macoun, Cat. Can. Pl. **6**: 62. 1890.

Plants smaller, sterile, in intricate mats, dirty yellowish to dark green or black; stems scarcely radiculose, defoliate or with distant, ovate, narrowly acuminate, recurved leaves; branches few, irregularly arranged, short, with many flagelliform branchlets, often with bulbils at their tips; leaves of branchlets rudimentary, scarcely costate. With the species but less common.

7. Leskea Williamsi Best, Bull. Torr. Bot. Club, **30**: 476. *pl. 16. figs. 55–68.* 1903.

Plants small, in spreading rather lustrous tufts, pale yellow to golden brown; stems slender, pinnately branched, 2–4 cm. long; *central strand none;* branches ascending, simple or with flagellate branchlets; lower stem-leaves decolorate, rotund-ovate, abruptly acuminate, costa short; upper stem-leaves appressed when dry, erect-spreading when moist, straight or subsecund, entire or *serrulate* above, ovate-lanceolate, acuminate, *acumen nearly as long as the biplicate body*, 0.25–0.35 mm. wide, 0.4–0.5 mm. long; margins plane or recurved below; costa thin, rarely extending beyond the middle; branch leaves 0.15–0.2 mm. wide, 0.25–0.4 mm. long, *often serrulate above; leaf cells smooth, clear;* median linear-rhomboidal to fusiform, subvermicular, about 6 μ wide, *3–5 times as long;* alar quadrate to transversely-oval, in about 4 rows, extending well up the margin and becoming oval-oblong. Dioicous; perichaetial bracts oblong-lanceolate, acuminate, *striate-plicate;* pedicel flexuose, reddish, about 1 cm. long; capsule straight, erect or inclined, oblong-cylindric, tapering at the base, often narrower in the upper half than in the lower; urn 2 mm. long, 0.7 mm. wide, brownish; teeth reddish, incurved when dry, lanceolate, confluent at base, finely striate below, rugulose above, divisural line distinct, ventral surface lamellose; *basal membrane strongly reticulated, about ¼ the length of the teeth;* segments narrow, concave-keeled, gaping, about as long as the teeth; cilia none; annulus of 2 rows of pellucid cells, deciduous with the operculum; operculum conic, straight or obliquely beaked; calyptra reaching to the base of the capsule; spores smooth, 10–13 μ, maturing in summer. Type locality, Montana.

ILLUSTRATIONS:—Best l. c.; *Pl. 52.*
On rocks and rotten wood, Montana, Minnesota, and Owen Sound, Ontario (Moxley).

Var. FILAMENTOSA Best, Bull. Torr. Bot. Club, 30: 477. 1903.

Sterile delicate plants with stems which are defoliate or with few rudimentary leaves, sparingly branched; branches filiform, diffusely spreading, with brittle, flagellate branchlets; branch-leaves smaller than those of the species; those of the branchlets still smaller and sometimes rudimentary.

EXSICCATI:—Drumm. Musc. Am. 219, in part; Brandegee's Mosses of S. Col. 38.
On rocks in the Rocky Mts.

8. LESKEA TECTORUM (A. Braun) Lindb. Bot. Notis. 1865: 73. 1865.

Pterogonium tectorum A. Braun; Brid. Bryol. Univ. 2: 582. 1827.
Pseudoleskea tectorum (A. Braun) Milde, Bot. Zeit. 1864, Beih. p. 8.
Leskea Wollei Aust. Bull. Torr. Bot. Club, 5: 28. 1874.
Pseudoleskea malacoclada C. M. & Kindb., Macoun, Cat. Can. Pl. 6: 182. 1892.
Anomodon subrigidulus Kindb. Eur. & N. Am. Bryin. 11. 1897.
Anomodon tectorum Kindb. Eur. and N. Am. Bryin. 11. 1897.

Plants small, in rather dense lustrous tufts, deep green to reddish-brown or black; stems 2–5 cm. long, pinnately branched; branches ascending, short, simple, sometimes with flagellate branchlets, sharply pointed when dry; *central strand small, distinct;* paraphyllia few or none, lanceolate; lower stem-leaves broadly ovate, abruptly and narrowly acuminate, acumen spreading or recurved; upper stem-leaves subdecurrent, ovate, abruptly acuminate; *acumen shorter than the concave scarcely plicate body; margins entire,* plane or recurved on one or both sides below; branch-leaves ovate, abruptly or gradually acuminate; margins plane, *entire,* very rarely minutely serrulate above; costa short, simple, sometimes forking, rarely none; leaf cells smooth, clear; median cells oval-oblong to oblong-rhomboidal, *rounded at both ends,* 9–12 μ wide, *1½–3 times as long;* alar transversely compressed in 5–7 rows; upper rhombic-oval or roundish. Dioicous; only sterile plants known from North America. Type locality Germany.

(Perichaetial bracts erect, long-acuminate, the inner shorter, blunt-pointed and coarsely serrate at the apex; seta purple, 1.5 cm. long; capsule cylindric, somewhat curved, reddish-brown; urn 2.7 mm. long × 0.75 mm. wide; annulus present; teeth of peristome lanceolate, yellowish; basal membrane of inner peristome 1/6 length of the teeth; segments about as long as the teeth, keeled; cilia none or rudimentary; spores in August.)†

ILLUSTRATIONS:—Husn. Musc. Gall. *pl. 86;* Best, Bull. Torr. Bot. Club, 30: *pl. 16. figs. 69–76; Pl. 52.*
On rocks, rotten wood and bases of trees, Lake Superior to British Columbia and from Yukon to the southern Rocky Mts..

Var. FLAGELLIFERA Best, Bull. Torr. Bot. Club, 30: 479. 1903.

This differs from the species in the usually defoliate stems; filiform branches with many, deciduous, flagellate branchlets; smaller branch-leaves. It differs from *L. Williamsi filamentosa* in its entire leaves and larger leaf cells. Widely distributed.

EXSICCATI:—Grout, N. Am. Musc. Pl. 219 & 413; Bartram, Mosses of S. Ariz. 160.

*9. LESKEA CYRTOPHYLLA Kindb.; Macoun, Cat. Can. Pl. 6: 169. 1892.

Leskea subcyrtophylla Card. & Thér., apparently unpublished.

Plants very small, in compact tufts, deep green to rusty brown; stems 1–2 cm. long, scarcely radiculose, irregularly branched; branches erect, simple or with flagellate branchlets; paraphyllia rarely present; stem-leaves somewhat spreading, roundish-ovate, concave, broadly inserted, 0.3–0.4 mm. wide, 0.4–0.5 mm. long, abruptly acuminate; acumen usually sharp-pointed; costa short, thin, usually forking; margins entire, sometimes recurved below; branch-leaves roundish-ovate, rather gradually acute or short-acuminate, often blunt-pointed, 0.2–0.25 mm. wide, 0.25–0.35 mm. long; *leaf cells rounded or angular, not uniform,* somewhat clear, with *usually a small flat subcentral papilla on each surface;* median cells oval-rhombic, 9–13 μ wide, 12–16 μ long; alar transversely compressed, in 5–7 rows. Apparently dioicous; only sterile plants known. Type locality Lake Nipigon, Canada. *Pl. 71.*

† Abstracted from Limpricht, Laubm. 2: 271.

On rocks and stones, Ontario, Minnesota, and Colorado.

This is very closely related to *L. tectorum* from which it is to be distinguished by the much more orbicular leaves which exhibit at least a few papillae.

In Dr. Grout's herbarium there is a packet of moss collected by C. F. Baker and J. M. Holzinger, May 31, 1896, in Colorado. It is labeled "*Leskea subcyrtophylla* Card. & Thér. Co-Type." I can find no record of such a species in the literature and assume it was unpublished. It differs little from *L. cyrtophylla.*

7. LINDBERGIA Kindb. Eur. & N. Am. Bryin. 1: 13. 1897.

Rather small, soft, loosely tufted plants; stems elongated, thickly and regularly foliate, irregularly divided and branched; paraphyllia few or lacking; leaves imbricate when dry, spreading to almost squarrose when moist, somewhat concave, not plicate, nearly or quite entire; margins plane; costa well developed in our species, reaching the leaf middle or beyond; leaf cells rounded oval to rhombic-hexagonal, papillose in our species. Monoicous; seta 5–20 mm. long; capsule erect and symmetric, oblong-ovoid; annulus present or lacking; inner peristome of a low membrane or lacking. Type species *L. brachyptera.*

LINDBERGIA BRACHYPTERA (Mitt.) Kindb. Eur. & N. Am. Bryin. 1: 13. 1897.

Pterogonium brachypterum Mitt. Journ. Linn. Soc. 8: 37. 1865.

Stems procumbent, irregularly pinnate with short branches, leaves densely imbricate, broadly deltoid-ovate, acuminate with a narrow acumination, concave; margins plane, minutely serrulate above; costa vanishing a little beyond the middle of the leaf; angular leaf cells minute, rounded, the others short-oval, longer at the apex, all distinctly papillose; perichaetial leaves erect, ovate-acuminate, entire; costa vanishing above the middle, with cells elongated, the alar lax. Monoicous; seta elongated ("½ inch"), rather stout, light colored; capsule ovoid-cylindric, erect, symmetric; operculum short-conic; peristome teeth short, inserted below the mouth of the capsule, the inner a short membrane.

British North America, *Drummond.*

The above description is translated from the original Latin. Mitten's type has been studied. The plants are stouter than in the var. *Austinii*, the leaves are deltoid-ovate to broadly rounded-ovate and more abruptly acuminate. The leaves are much broader than those figured by Sullivant for the variety, but the shape of the leaves varies greatly, even on the same plant. In a plant collected by the author, named *Austinii* by Best, there are leaves that will fit either shape. The peristomes do not differ materially.

Var. AUSTINII Sull. **n. comb.**

Leskea Austinii Sull. Icones Musc. Suppl. 81. *pl. 61.* 1874.
Fabroleskea Austinii Best, Bull. Torr. Bot. Club, **25**: 108. 1898.
Lindbergia Austinii Broth. in Engler & Prantl, Musci (Ed. 1) 993. 1907.

Plants of medium size, bright green in the younger parts; stems 2–3 cm. long; *stem leaves widely spreading to squarrose when moist*, concave, ovate to ovate-lanceolate, gradually broadly acuminate to rather abruptly and slenderly acuminate, 0.7–1.2 x 0.35–0.5 mm.; margins plane, entire or slightly irregular above; costa strong usually reaching beyond the leaf middle; leaf cells thick-walled, the *median rounded-oval to rhombic-fusiform, 9–12 μ wide, 1½–2 : 1*, somewhat elongated in the costal region, basal and marginal rounded and nearly isodiametric, apical elongated, *all except the apical with a large central papilla on each surface;* perichaetial leaves oblong-lanceolate, more gradually and more slenderly long-acuminate, cells elongate, scarcely or not at all papillose. Seta smooth, 8–20 mm. long; capsule oblong-ovoid, ± 1.5 mm. long; operculum conic, blunt; *annulus lacking; pseudannulus of 7 rows of oblong-oval compressed yellowish cells;* outer peristome of 16 rather broad, obtuse, lanceolate, *papillose teeth, deeply inserted* and confluent at base; inner peristome of a narrow yellowish membrane, often scarcely apparent; spores minutely roughened, 19–26 μ in diameter, maturing late winter to early spring. Type locality Illinois, according to Best.

ILLUSTRATIONS:—Sull. l. c.; *Pl. 51.*
EXSICCATI:—Aust. Musc. Appal. 267; R. & C. Musc. Am. Sept. 317.

On bark of trees and stones, also on limestone; rare but widely distributed; Quebec to Minnesota, and British Columbia, south to S. Carolina, Kansas and Arizona.

Gemmae of very short branchlets with minute papillose leaves are present in most specimens. This species has the leaves of a *Leskea* with the peristome of the Fabroniaceae. (See Best, l. c.)

L. Mexicana (Card

8. PTERIGYNANDRUM Hedw. Stirp. Crypt. **4**: 55. *pl. 20.* 1793. And Sp. Musc. 80. 1801.

We have only one species.

PTERIGYNANDRUM FILIFORME Hedw. l. c. 81. 1801.*

Pterigynandrum filiforme cristatum (Hampe) Lesq. & James Man. 289. 1884.

Plants small, slender in thin patches resembling *Leskea;* primary stems creeping; secondary ascending with irregularly placed, often flagelliform branches, usually less than 10 mm. long, julaceous; paraphyllia small, varying from filiform to many-branched forms; leaves small, 0.4–0.6 mm. long, obovate to oval-elliptic, close, closely imbricate when dry, concave, not plicate, occasionally somewhat secund, short-acuminate to almost obtuse, slightly denticulate or entire above, more or less papillose at back by the projecting cell angles; margin somewhat reflexed below; costa almost wanting or short and double or occasionally single and reaching well towards the leaf middle; median leaf cells narrowly rhomboidal to shortly linear-vermicular, about 7 μ wide, 3–5 : 1, broader and shorter at the apex; angular cells quadrate to short rectangular in several rows; inner perichaetial leaves broadly lanceolate, sheathing, acute, with plane entire margins. Dioicous; seta 8–10 mm. long; capsules erect and usually symmetric, 1–2 mm. long; annulus present; operculum conic-rostrate; peristome teeth rather short and narrow; inner peristome of 16 short irregular segments, without cilia, basal membrane very narrow or lacking; spores in summer, rarely produced. Type locality, Mecklenburg.

ILLUSTRATIONS:—Bry. Eur. *pl. 466;* M. H. M. *f. 134.*

EXSICCATI:—Drumm. Musc. Am. 77; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 230b, (Ed. 2) 348; Aust. Musc. Appal. 280; Grout, N. Am. Musc. Pl. 147, 383 & Suppl. 3; Allen, Mosses Cascade Mts. 147; R. & C. Musc. Am. Sept. 384.

On roots and bases of trees, also on damp stones. Greenland to British Columbia, southwards to northern U. S. Variations in this species are common and often extreme. The average American plant is somewhat different from the European but almost any form of one continent can be matched from the other.

A frequent form in the West has secondary stems and branches together reaching 2–3 cm. in length, flagelliferous at ends, scarcely julaceous; leaves more distant, more strongly serrate and more sharply acute.

Forma PAPILLOSULUM (C. M. & Kindb.) **n. comb.**

Pterigynandrum papillosulum C. M. & Kindb. Macoun, Cat. Can. Pl. **6**: 165. 1892.

Plants rather slender, *not* "blunt and turgid"; leaves acute and sharply but finely toothed above, in many cases finely toothed to area of quadrate angular cells, with papillae at back exceptionally *large and sharp, not* "less papillose" as described. Plants from type collection, "Deer Park, B. C., June 4th, 1890 (J. Macoun)," Can. Musci 553, seen and studied.

Var. MINUS Lesq. & James, Manual 289. 1884.

A small depauperate form of unfavorable habitat on rocks; leaves scarcely papillose or serrate; costa almost obsolete. The original description says that the segments are as long as the teeth. This has not been verified since, as fruit is extremely rare. The variety as described above is apparently not rare within the range of the species.

EXSICCATI:—Grout, N. Am. Musc. Pl. 142 & 142a.

Var. DECIPIENS (Web. & Mohr) Limpr. l. c. 786.

Neckera decipiens Web. & Mohr. Bot. Taschenb. 241 & 473. 1807.
Pterigynandrum heteropterum Brid. Bryol. Univ. **2**: 176. 1827.

A more robust better developed form; branches blunt, curved, never flagelliform, leaves secund, 1–1.2 mm. long and mostly bluntly apiculate. Capsule often unsymmetric, reaching 3 mm. in length; peristome better developed; segments as long as the teeth.

Reported from Newfoundland, Cape Breton Island and the Yukon.

Subfamily THELIEAE.

Small mosses with julaceous branches and mostly broadly ovate to subcircular, apiculate to acuminate leaves, concave and more or less spoon-shaped; leaf cells strongly papillose with very large single or forked

*For a long list of synonyms see Limpricht, Laubm. **2**: 784.

papillae (except *Myurella* species); costa single, rather short to almost lacking, sometimes forking; capsules erect and symmetric; inner peristome imperfect to perfect.

KEY TO THE GENERA.

Paraphyllia present; segments of inner peristome rudimentary or lacking..... *10. Thelia.*
Paraphyllia lacking; segments of inner peristome well developed, with cilia..... *9. Myurella.*

9. MYURELLA Bry. Eur. fasc. 46–47. 1851.

Plants very slender, forming loose tufts or mats, light to bluish-green; stems ascending to erect, irregularly branched, the branches often subfasciculate, with leaves 0.3–0.5 mm. thick; small-leaved stolons present; leaves round-ovate, obtuse, abruptly apiculate or acuminate, very concave; margins plane to involute; costa mostly short and slender or nearly lacking; leaf cells small, elliptic to elliptic-fusiform, smooth or papillose; perichaetial leaves very different, lanceolate to ovate-lanceolate, long acuminate with elongated leaf cells, usually smooth. Dioicous; seta smooth; capsules erect to inclined, symmetric or nearly so, oblong-ovoid from a short neck; peristome perfect, with segments about the length of the teeth, cilia shorter; operculum conic. Type species, *M. julacea.*

KEY.

1. Plants usually densely cespitose; leaves mostly obtuse, often apiculate..... *1. julacea.*
   Plants often loosely tufted; leaves apiculate to acuminate..... 2.
2. Leaves with a single large papilla on lumen of each cell dorsally..... *3. Careyana.*
   Leaves with low papillae dorsally at cell angles..... 3.
3. Leaves acuminate, upper ½ spreading to squarrose, costa often well developed..... *4. squarrosa.*
   Leaves apiculate, costa wanting or nearly so..... *2. tenerrima.*

1. MYURELLA JULACEA (Vill., Schwaegr.) Bry. Eur. l. c. *pl. 560.*

Leskea julacea Schwaegr. in Schultes' Reise auf d. Glockner **2:** 363. 1804.

Plants light green above, cespitose, often densely so, cushions reaching 2 cm. in depth, or other times in loose mats, somewhat brittle when dry; stems suberect, divided, freely and irregularly branching; branches crowded, julaceous, almost filiform, reaching 10–12 mm. in length, usually shorter; leaves imbricate-appressed, wet or dry, subcircular to rounded-ovate, narrow at the insertion, very concave, *obtuse to short-apiculate,* 0.3–0.5 mm. long, more or less papillose dorsally by the projecting cell angles, serrulate by projecting cell angles, especially near base; costa faint to lacking; median leaf cells irregular, rhombic-hexagonal to rhomboidal, 15–20 μ long, ± 2 : 1; median basal elongated, at the insertion and angles short-rectangular to quadrate. Capsule oblong-ovoid, with neck and operculum reaching 1.5 mm. long; annulus large; spores in summer. Type locality, France.

ILLUSTRATIONS:—Bry. Eur. l. c.; Limpr. Laubm. **2:** 750, *f. 342; Pl. 50.*
EXSICCATI:—Aust. Musc. Appal. 266; Grout, N. Am. Musc. Pl. 376; Drumm. Musc. Am. 220 (as *Hypnum moniliforme*).
A subalpine moss, growing on rocks, especially limestone; Greenland west to the Rocky Mts. and Oregon, north to the Yukon, south to Connecticut, New York and Colorado; rare.

Var. SCABRIFOLIA Lindb. Musc. Scand. 37. 1879.

Leaves distinctly apiculate, more strongly papillose, serrate with larger teeth at base. Old marble quarry, Dorset, Vermont, N. Am. Musc. Pl. 435 (associated with *M. Careyana*).

2. MYURELLA TENERRIMA (Brid.) Lindb. Musc. Scand. 37. 1879.

Pterigynandrum (?) tenerrimum Brid. Musc. Recent. Suppl. **4:** 132. 1819.
Isothecium apiculatum Huebn. Muscol. Germ. 598. 1833.
Myurella apiculata Bry. Eur. l. c. *pl. 560.*

Resembling the last. Plants yellowish green, less glaucous, with *leaves distinctly more distant and less closely appressed,* all *with an apiculus which often becomes a rather slender acumination* and is more or less spreading when moist; margins less markedly serrulate; costa almost or quite lacking; leaf cells usually less papillose, often smooth. Type locality, Switzerland.

ILLUSTRATIONS:—Bry. Eur. *pl. 560; Pl. 50.*
EXSICCATI:—Hunker Creek, Yukon, Macoun, No. 231; Drumm Musc. Am. 220 (in part).
On moist alpine rocks, very rare; Greenland, Utah, British Columbia, and Dawson in Yukon Terr. (Williams).

The leaf apices are less recurved than the descriptions would lead one to believe; they are slightly more spreading than the body of the leaf. Williams' plants have some leaves slenderly long-acuminate. His fruiting plants all seem to be *M. Careyana.*

Myurella means little mouse tail and Limpricht describes this species in appearance like a string of pearls (perlschnurartig).

M. julacea scabrida approaches this species, but may be distinguished by the lighter, more glaucous color, the more serrulate leaf margins and the more strongly papillose leaf cells.

Drummond's Musc. Am. no. 220 (*Hypnum moniliforme*) seems to have included both this and the preceding species. Both were also collected at Wrangel Bay in the Arctic, according to Bryhn.*

3. MYURELLA CAREYANA Sull. Mosses U. S. 61. *pl. 5.* 1856.

†*Myurella gracilis* (Weinm.) Lindb. in Medd. Soc. p. Faun et Fl. Fenn. **13**: 354. 1886.
Hypnum gracile Weinm. in Syll. M. Frond. **1845**: 46. 1845.

Plants slender, small, in dense cushions or loose mats, sometimes 15 mm. or more thick, light to glaucous-green; stems erect to ascending, stoloniferous, bushy-branched; branches often flagelliform at the end, julaceous, brittle when dry, 5–10 mm. long; leaves loosely imbricate to erect-open, rather distant, occasionally closely imbricate and simulating *M. julacea* in gross appearance, reaching 0.6 mm. in length, usually shorter, broadly round-ovate to subcircular, strongly narrowed to the insertion, rather abruptly apiculate to slenderly acuminate, very concave; margins *spinose-dentate from base to apex;* costa short or lacking; median leaf cells rounded-rhombic, ± 10 μ wide, 1.5–2 : 1, pellucid, each with *a very large dorsal papilla over the lumen;* basal and apical cells elongated and nearly smooth. Seta less than 1 cm. long; capsules suberect and nearly symmetric, oblong-ovoid, urn with neck about 1 mm. long; operculum conic; peristome perfect hypnaceous with two cilia shorter than the teeth. Type from New England.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 83; Pl. 51.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 250, (Ed. 2) 373; Aust. Musc. Appal. 265; R. & C. Musc. Am. Sept. 234b; Grout, N. Am. Musc. Pl. 205.
In crevices and hollows of limestone rocks in damp shaded places; Nova Scotia to the Yukon, south to North Carolina, Tennessee and Iowa. William's specimens from the Yukon, identified as *M. apiculata* in fruit, is this species. The capsules are empty and almost bell-shaped. While the species is common in limestone regions, spores are very rarely produced.

4. MYURELLA SQUARROSA n. sp.

Plantae laxe caespitosae; caulis suberectus, 2–3 mm. longus; folia patula vel squarrosa, ovata, prerupte acuminata, plus minusve distincte costata.

Plants in thin light-green mats; secondary stems and branches very short, 2–3 mm., suberect; *leaves spreading to squarrose from a subclasping, broadly ovate base,* rather abruptly acuminate, reaching 0.6 mm. in length, *acumination about ⅓ the leaf length,* strongly narrowed to the insertion, nearly entire to subserrulate with projecting cell angles, smooth or faintly papillose dorsally in the upper leaves; costa short and rather faint *to stouter and reaching the leaf middle;* median leaf cells irregularly oblong to oblong-rhomboidal, at basal angles a large area of smaller, quadrate to short-rectangular cells; perichaetial leaves subclasping, the inner slenderly long-acuminate. Seta 4–6 mm. long, smooth; capsules oblong-cylindric, with long-conic operculum ± 1.6 mm. long, mostly slightly inclined and nearly symmetric when moist, when dry inclined *to drooping and somewhat curved:* annulus ?; peristome perfect hypnaceous, with segments as long as the teeth and one or two well developed cilia; spores in late spring. Type on trees, Franklin Co., Nebraska, May, 1899, Coll. J. J. Sheldon, comm. K. Wolfe.

This plant was originally determined as *M. apiculata* by the author and confirmed by Dr. Best, but the characters emphasized above and its habitat on trees make it clearly distinct after a careful comparison with European material.

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*Forh. Vid.-Selsk. Christ. **1908**[5]: 21. 1908.
†There were two species named *Hypnum gracile* before Weinmann's. This seems to rule out *gracilis* as a specific name for this species.

10. THELIA Sull. Mosses U. S. 60. 1856.

Plants rather slender, often densely cespitose, sometimes in thinner closely interwoven mats; stems usually creeping and ascending at the ends, branching more or less regularly pinnate; branches short, erect to ascending, strongly julaceous, obtuse, *light to glaucous-green;* paraphyllia various; leaves densely imbricate even when moist, broadly rounded-ovate, very concave, abruptly subulate-acuminate, more or less decurrent; margins nearly plane, mostly ciliate-serrulate, ciliate to laciniate below; costa single, reaching the leaf middle, or short or forking; median leaf cells rhombic to fusiform, each bearing dorsally an enormous papilla, which is simple or forked; median basal and the apical cells elongate, some without papillae. Dioicous; seta smooth, 5–15 mm. long; capsules erect and symmetric, oblong to cylindric; annulus lacking; peristome whitish, the teeth very slender; inner peristome a basal membrane with segments very rudimentary or lacking; operculum conic-rostrate; calyptra smooth, cucullate. Type species, *T. hirtella.*

Key.

1. Dorsal leaf papillae single pointed ..... *1. hirtella.*
   Dorsal leaf papillae with two or more points ..... 2.
2. Plants growing mainly on bark of trees, most leaves with ciliate margins ..... *2. asprella.*
   Plants growing mainly on sand and rocks; most leaves without ciliate margins ..... *3. Lescurii.*

1. THELIA HIRTELLA (Hedw.) Sull. l. c.

Pterigynandrum hirtellum Hedw. Sp. Musc. 83. *pl. 17, f. 1–6.* 1801.
Thelia robusta Duby, Flora, **58**: 284. 1875.
Thelia compacta Kindb. Ottawa Nat. **4**: 62. 1890.

Light green to slightly glaucous, in thin, interwoven, loosely adherent mats; primary stems creeping, reaching 5 cm. or more in length, often regularly pinnately branched with numerous short (2–5 mm.) crowded, julaceous branches; leaves broadly ovate to subcircular, strongly concave, abruptly and narrowly acuminate, decurrent, spinulose-dentate above and fimbriate-ciliate below; costa reaching the leaf middle; leaf cells, except the apical and median basal, rhomboidal to fusiform, each with a single long, slender and unbranched papilla on the dorsal surface; apical cells linear, basal elongated, alar subquadrate; perichaetial leaves narrower and more strongly fimbriate-ciliate. Seta 5–10 mm. long; capsule oblong-cylindric; urn 2–2.5 mm. long; peristome teeth noticeably whitish; inner peristome a membrane about ⅓ the length of the teeth; spores in autumn. Type locality, Lancaster, Pennsylvania.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 80; Pl. 49.*
EXSICCATI:—Drumm. Musc. Am. S. States 90 (as *Pterogonium*); Sull. Musc. Allegh. 85; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 247, (Ed. 2) 390; R. & C. Musc. Am. Sept. 191; Grout, N. Am. Musc. Pl. 155, 22; Aust. Musc. Appal. 262.
On bases and trunks of trees in woods; New Brunswick to Nebraska, south to the Gulf; very common in the southern portion of its range.

2. THELIA ASPRELLA Sull. l. c.

Leskea asprella Bry. Eur. Mon. 2. 1850. (name only)

Similar to the last but more markedly glaucous-green, usually in much thicker mats or cushions, reaching 2 cm. in thickness; branching less regularly pinnate; leaves bordered with rather longer cilia; papillae 2–3 pointed. Habitat much as in the last and not rarely growing with it. Type locality, eastern U. S.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 81;* M. H. M. *pl. 60.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 248, (Ed. 2) 371; Aust. Musc. Appal. 263; Grout, N. Am. Musc. Pl. 33, Musci Perfecti 142; R. & C. Musc. Am. Sept. 84 & 84c.
New England to Ontario and Minnesota, south to the Gulf. Less frequent than the preceding, especially in the northern part of its range.

*3. THELIA LESCURII Sull. l. c.

Subspecies or variety of the last and intergrading with it; typically whitish and more glaucous in color; stems shorter and subfasciculately branching, leaves inclined to be deltoid-ovate and more shortly acuminate, less distinctly ciliate on the margins in majority of leaves; dorsal leaf papillae 3–4 pointed; capsules averaging longer, urn reaching 3 mm.; membrane of inner peristome longer with segments more or less apparent.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 82; Pl. 49.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 249, (Ed. 2) 372; Aust. Musc. Appal. 264; Grout, N. Am. Musc. Pl. 14; R. & C. Musc. Am. Sept. 191.
In sand or on flat rocks or ledges, often in the open, rarely on trees; New England to Wisconsin, south to the Gulf; more abundant southwards.

Subfamily ANOMODONTEAE.

Plants mostly large and coarse; a few slender and subfiliform; paraphyllia usually lacking; leaf cells very small and dense, rounded to subhexagonal, densely papillose over the lumen (except *Herpetineurum*); capsules erect and symmetric or nearly so; peristome of 16 slender teeth; inner peristome of a short basal membrane, often with rather short slender segments; cilia usually lacking.

11. HERPETINEURUM (C. Muell.) Card. Beihefte Bot. Centralbl. 19²: 127. 1905.

Anomodon sect. *Herpetineuron* C. Muell. Flora **73**: 495. 1890.

Plants moderately robust, dark green; secondary stems simple to several times divided, densely foliate; paraphyllia lacking; leaves 5-ranked, strongly and irregularly serrate above; costa strong, not percurrent, flexuous, smooth; leaf cells small, not papillose. Dioicous; sporophyte much as in *Anomodon*. Type species, *H. toccoae*.

HERPETINEURUM TOCCOAE (Sull. & Lesq.) Card. l. c. 128.

Anomodon toccoae Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 240. 1856.
Anomodon devolutus Mitt. Musc. Ind. Or. 127. 1859.
Neckera (Papillaria) sciuroides Hampe, Enum. Musc. Brasil. 43. 1879.
Anomodon (Herpetineuron) flagelligerus C. Muell. Nuov. Giorn. Bot. Ital. n. s. **4**: 273. 1897.*

Plants loosely cespitose; secondary stems little divided, 2–3 cm. long, sometimes flagelliferous with slender narrowly acuminate leaves; normal secondary stems often subcircinnate; leaves rather irregularly imbricate when dry, erect-spreading and often somewhat secund when moist, ovate-lanceolate, concave and slightly plicate at base with margins reflexed, a little more than 2 mm. long, usually somewhat unsymmetric and curved to one side; *margins plane and strongly serrate above; costa strong, markedly flexuous above*, ending in or near the apex; leaf cells very small, nearly uniform in size, 6–7 μ in diameter, dense and *thick-walled but not papillose*, mostly rounded-quadrate, sometimes with an oval or oblong lumen; upper perichaetial leaves lanceolate, gradually narrowed to a long filiform acumination, costate. Seta about 2 cm. long; capsule oblong-elliptic, ± 3 mm. long, erect and symmetric; operculum acutely conic; annulus present; teeth of outer peristome well developed; segments linear, less than half the length of the teeth, attached to a narrow basal membrane. Sporophytes unknown from N. America. Type locality, Toccoa Falls, Georgia.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 76a: Pl. 56.*
EXSICCATI:—Sull. & Lesq. l. c. & (Ed. 2) 363; Grout, N. Am. Musc. Pl. Suppl. 32.
On rocks, North Carolina, Georgia, Florida and Louisiana, also in Asia, the East Indies, Africa and South America.

12. ANOMODON Hook. & Taylor, Musc. Brit. (Ed. 1) 79. 1818.

Plants mostly dark green in rather dense mats or cushions, rather large and coarse, often brownish or ochraceous below; primary stems creeping and adhering to the substratum, *nearly leafless, sending up secondary stems in large numbers;* branches sometimes flagelliform; *paraphyllia lacking;* leaves brittle, close, usually equally spreading in 5 rows, subclasping at base, *lingulate from an ovate base* in most of our species, little or not at all decurrent; margins plane and entire; costa strong, in most cases ending below the apex; median leaf cells small, rounded-hexagonal, *densely papillose on both sides with papillae rarely single*, often double-pointed, only the median basal elongated and smooth. Dioicous; setae elongated, smooth; capsules erect and symmetric, oblong-cylindric, rarely slightly curved, not narrowed below the mouth when dry and empty; peristome teeth narrowly linear-lanceolate; inner peristome of rather short linear segments from a low basal membrane; cilia usually lacking, sometimes rudimentary; operculum conic to rostrate; calyptra cucullate, small. Type species, *A. viticulosus*.

Anomodon californicus Lesq. is a *Triquetrella*, *T. californicus* **n. comb.** I am indebted to Mr. H. N. Dixon for the identification. He has also compared it with the type of *T. ferruginea* (Schimp.) Thér., which is near it but distinct.

* For full synonymy see Salmon, Journ. Bot. **39**: 363. 1901.

KEY.

1. Secondary stems and branches slender, usually julaceous when dry	2.
Secondary stems and branches coarse, scarcely julaceous	3.
2. Leaves slenderly acuminate, ending in a hair point; plants growing at base of trees and about ledges	*5. rostratus.*
Leaves narrowly lingulate from an ovate base, obtuse to apiculate; plants growing on bark of trees as a rule	*6. tristis.*
3. Secondary stems much branched as a rule, many branches attenuate to flagelliform; many of the leaves apiculate and toothed at the apex	*4. attenuatus.*
Secondary stems more sparingly branched, no attenuate branches	4.
4. Upper portion of leaves lingulate-lanceolate, conspicuously tapering to the apex, somewhat contorted and crisped when dry, often secund; plants usually growing on rocks	*1. viticulosus.*
Upper portion of leaves lingulate and of nearly equal breadth, not secund; plants nearly always growing on bark of trees, stumps or logs	5.
5. Leaves somewhat crisped when dry with points incurved, not decurrent, having large fimbriate-papillose auricles, often apiculate	*3. Rugelii.*
Leaves scarcely contorted when dry, somewhat irregularly appressed, decurrent, without auricles, not apiculate	*2. minor.*

1. ANOMODON VITICULOSUS (L. Hedw.) Hook. & Tayl. Musc. Brit. (Ed. 1) 79. *pl. 22.* 1818.

Neckera viticulosa Hedw. Sp. Musc. 209. *pl. 48, f. 4–5.* 1801.

Our largest species, in wide thick tufts, dark green above, brownish below; secondary stems 4–10 cm. long, often two or three times divided, sometimes appearing bent by reason of innovations, very sparingly branched; central strand present; leaves of secondary stems larger above, reaching 3 mm. long, often more or less secund or subfalcate, contorted, scarcely crispate when dry, *lingulate-lanceolate* from an ovate base, *at apex obtusely acute*, sometimes crenulate; costa strong reaching to near the apex, pellucid; leaf cells rounded-hexagonal to rounded quadrate, about 9 μ in diameter, densely papillose on both sides, opaque and indistinct; at median base an area of elongated less dense cells; inner perichaetial leaves ovate at base, long linear-acuminate above. Seta 12–20 mm. long; capsule usually erect and symmetric, cylindric to oblong-cylindric; urn 2.4–3 mm. long, wrinkled when dry and empty; operculum conic-rostrate, 0.75 mm. long; annulus present; *segments of inner peristome as a rule rather better developed than in the two following species*, ½–⅔ the length of the teeth; spores in winter, infrequently produced. Type locality European (near Giessen, collected by Dillenius).

ILLUSTRATIONS:—Bry. Eur. *pl. 476;* M. H. M. *f. 136.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 359; Sull. Musc. Allegh. 73; Aust. Musc. Appal. 278.
Mostly on shaded rocks, less frequently on bases of trees; Lower Canada and eastern U. S. east of the Mississippi, south to Virginia. Widely distributed but rare and local, apparently calciphile.

Var. MICROPHYLLUS Kindb. Laubm. Schwed. & Norw. 1883.

Dr. Best so identified N. Am. Musc. Pl. 340. Limpricht says of it: a depauperate form, densely tufted, much branched and with smaller leaves.

2. ANOMODON MINOR (P. B.) Lindberg, Fauna & Flora Fenn. 9: 267. 1882.*

Neckera viticulosa var. *minor* Hedw. Sp. Musc. 210. *pl. 48, f. 6–8.* 1801.
Neckera minor P. B. Prod. 78. 1805.
Anomodon obtusifolius Br. & Sch. in Hook. London Journ. Bot. **2**: 668. 1843.

Plants in wide loose mats; secondary stems simple or sparingly divided, 2–4 cm. long, densely foliate; central strand present, consisting of small cells; leaves of secondary stems usually more or less two-ranked, appressed when dry, spreading when moist, reaching 2 mm. in length, somewhat decurrent, broadly lingulate and rounded-obtuse from an ovate base, thick and opaque, densely papillose on both sides with small papillae; costa strong, vanishing below the apex; leaf cells small, 9–12 μ in diameter, rounded-hexagonal;

* Fuenrohr, Flora 12²: Ergaenz. 49. 1829, did not make the combination. He merely assigned a list of species of *Neckera* to *Anomodon.*

median basal elongated, clear, slightly or not at all papillose; perichaetial leaves sheathing. Seta about 1 cm. long; capsules erect and symmetric, with operculum 2–3 mm. long; annulus present, well developed; operculum slenderly conic to rostellate; segments of inner peristome very short to lacking, from a very low basal membrane; spores in late fall or winter. Type locality, eastern North America (Muhlenberg), probably Pennsylvania.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 74;* Hedw. l. c.; M. H. M. *pl. 59;* Jennings, Mosses of Western Pa. *pl. 34.*

EXSICCATI:—Drumm. Musc. Am. 163; Sull. Musc. Allegh. 74; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 283, (Ed. 2) 360; Aust. Musc. Appal. 275; R. &. C. Musc. Am. Sept. 88; Grout, N. Am. Musc. Pl. 63.

Usually on bases of trees in moist woods, occasionally on rocks; New Brunswick to Florida and Texas, west to South Dakota.

Distinguished from *A. viticulosus* by its smaller size, less contorted leaves with a broader lingulate upper portion and less developed inner peristome. Any *Anomodon* with any of the leaves acute, apiculate or serrulate at apex is pretty surely not this species.

3. ANOMODON RUGELII (C. Muell.) Keissl. Ann. Hofmus. Wien **15**: 214. 1900.

Hypnum Rugelii C. Muell. Syn. **2**: 473, & *Leskea apiculata* Schimp. in litt. 1851.
Anomodon apiculatus Bry. Eur. fasc. 44–45. 1850 (name only).

In many respects resembling *A. minor*, compared as follows: secondary stems 2–6 cm. long; *leaves crispate when dry*, not decurrent but with *large rounded, fimbriate-papillose auricles*,* the shorter, broadly ovate base more abruptly narrowed to the lingulate portion, shorter, 1.5–1.8 mm. long, less opaque with larger papillae, often apiculate and often with apex incurved, upper margins often more or less incurved, sometimes serrulate at apex. Seta ± 1 cm. long, capsule a little longer and more slender, longitudinally wrinkled when dry and empty; annulus lacking; spores in autumn, infrequently produced. Type locality, Smoky Mts., Tennessee (Rugel).

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 75;* Jennings, Mosses Western Pa. *pl. 34;* M. H. M. *f. 135*, p. 258.

EXSICCATI:—Drumm. Musc. Am. 163 (as *A. viticulosus*); Aust. Musc. Appal. 277; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 237, (Ed. 2) 358; Grout, N. Am. Musc. Pl. 486.

On shaded rocks bases of trees and old logs in cool moist woods, mostly in elevated regions; New England to Michigan, south to Georgia, rather rare.

4. ANOMODON ATTENUATUS (Schreb., Hedw.) Hueben. Muscol. Germ. 562. 1832.

Leskea attenuata Hedw. Sp. Musc. 230. 1801.

Plants in loose wide mats; secondary stems usually shorter than in the preceding species, abundantly branching with many branches slender to flagelliform; ends of stems and larger branches often blunt and curved when dry; central strand lacking; leaves appressed and often somewhat contorted when dry, rarely, if ever, crisped, spreading when moist, sometimes secund, 1–1.8 mm. long on the main stems and branches, broadly ovate at base, gradually or abruptly narrowed to an upper sublingulate portion, which is proportionately much shorter than in the preceding species, narrowed to the insertion, usually rounded-apiculate or subacute at the apex, mostly somewhat serrulate near the apiculus; costa strong, ending near the apex; leaf cells densely papillose on both sides, obscure, irregularly hexagonal to rounded-quadrate, 6–9 μ in diameter; median basal elongated and less opaque. Setae 1.5–2 cm. long; capsules cylindric, erect and symmetric or nearly so; urn 2–3 mm. long; annulus narrow or lacking; operculum rostrate, about ½ the length of the urn; segments of inner peristome filiform, nearly as long as the teeth; spores in autumn. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl. 475;* Jennings, Mosses Western Pa. *pl. 34;* M. H. M. *f. 137.*

EXSICCATI:—Drumm. Musc. Am. 226 (as *Hypnum*), S. States 103; Sull. Musc. Allegh. 61 (as *Leskea*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 239; Aust. Musc. Appal. 274; R. & C. Musc. Am. Sept. 87; Grout, N. Am. Musc. Pl. 36, 36a and 262.

Mostly on shaded rocks, occasionally on bases of trees; eastern Canada to British Columbia, south to Florida, Louisiana, Missouri and Arizona. Our most common species.

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* The characteristic fimbriate-papillose auricles remain on the stem when the leaves are removed unless great care is taken. The decurrent basal angles of the next frequently bear large branched papillae, but they are much less conspicuous in that species.

Occasional diminutive, freely branching forms are found that are almost worthy of varietal rank, but these have the crispate leaves and fimbriate auricles.

5. ANOMODON ROSTRATUS (Hedw.) Schimp. Syn. (Ed. 1) 488. 1860.

Leskea rostrata Hedw. Sp. Musc. 226. *pl. 55.* 1801.

Plants more slender than the other species (except *tristis*), growing in dense yellowish green mats, the slender julaceous secondary stems and short branches (about 4 mm. long) appearing like the pile of a coarse velvet; primary stems creeping, irregularly branched; central strand present, small; leaves densely imbricate, concave and ovate at base, narrowly lanceolate-acuminate above, *ending in a long hyaline piliferous apex*, 0.75–0.9 mm. long, crenulate-papillose on the more or less recurved margins; costa strong, ending a little below the apex; leaf cells rounded-hexagonal to rounded-quadrate, opaque and with several papillae on each surface, the marginal 8–10 μ in diameter, the median more elongated; median basal elongated, less dense and slightly or not at all papillose; perichaetial leaves reaching 2 mm. in length, ecostate, the inner with a long filiform acumination which is often ½ the length of the leaf. Seta 6–10 mm. long; capsule ovoid to oblong-ovoid, erect, symmetric, chestnut-colored; urn 1–2 mm. long; operculum obliquely rostrate, about ½ the length of the urn; annulus present; segments of inner peristome nearly as long as the teeth, from a basal membrane ⅓ the height of the teeth; spores in autumn. Type locality, Lancaster, Pennsylvania.

ILLUSTRATIONS:—Bry. Eur. *pl. 473;* M. H. M. *f. 138;* Jennings, Mosses Western Pa. *pl. 34.*

EXSICCATI:—Drumm. Musc. Am. 288 and 79 (*Pterogonium hirtellum* Hedw.), S. States 104 (as *Leskea*); Sull. Musc. Allegh. 63; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 244 (as *Leskea*), (Ed. 2) 366; Aust. Musc. Appal. 272; R. & C. Musc. Am. Sept. 86; Grout, N. Am. Musc. Pl. 102, Musci Perfecti 155.

Moist places around the bases of trees and ledges, very common in the northeastern U. S. & eastern Canada, south to the Gulf, west to Arizona and Colorado; reported from Vancouver Id. by Macoun.

6. ANOMODON TRISTIS (Cesati) Sull. Mosses U. S. 58. 1856.

Leskea tristis Cesati in De Not. Syllab. Musc. 67. 1838.
Haplohymenium triste (Cesati) Kindb. [according to Brotherus, Engler & Prantl, Musci, (Ed. 1) 986.*]
Leskea fragilis Hook. & Wils. in Drumm. Musc. Am. S. States 101. 1841.

Plants slender, about the size of the smaller Leskeas, dull green, in thin loosely interwoven mats; stems prostrate or pendent, irregularly divided, irregularly to subpinnately branching; branchlets erect to ascending; leaves appressed when dry, squarrose when moist, 0.5–0.8 mm. long, very brittle and often broken except at the tips of the stems and branches, exceedingly variable in outline in the species and even on different parts of the same plant; stem leaves lanceolate from an ovate clasping base, broadly acute to very slender at apex, often a hyaline filament at the apex; branch leaves narrowly lingulate and usually apiculate to lanceolate, from an ovate base, crenulate on the margins by the turgid bulging papillose cells, apex rounded to apiculate; costa ending about the leaf middle, rough at back with large papillae; median leaf cells rounded polygonal, almost isodiametric, turgid, with several papillae on each surface, 10–15 μ in diameter, smaller at the margins, a few basal cells near the costa elongated and nearly or quite smooth; spores not found in N. America. Type locality, Italy.

ILLUSTRATIONS:—Jennings, Mosses Western Pa. *pl. 34;* Broth. Engler & Prantl, Musci (Ed. 1) *f. 716;* Roth, Europ. Laubm. 2: *pl. 35;* Moenk. Laubm. Europ. *f. 153a; Pl. 57.*

EXSICCATI:—Drumm. l. c., Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 241, (Ed. 2) 363; R. & C. Musc. Am. Sept. 195; Grout, N. Am. Musc. Pl. 195.

Mostly on bark of trees and shrubs, occasionally on rocks; Nova Scotia to South Carolina, west to Minnesota; infrequent and local. Most authors state that the leaves are mostly narrowly lingulate above. While this is true of some specimens, the stem leaves of most specimens examined, Italian as well as American, are lanceolate to subulate above and often slenderly acute. A specimen from Snake Mt., Vermont, on limestone in the Champlain water shed, has no lingulate leaves except on the smaller branches; lingulate leaves when present are usually apiculate.

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* *Haplohymenium* Dozy & Molk. M. Frond. Arch. Ind. 125. 1854. is the same as *Haplohymenium* Schwaegr. Suppl. 3^2, section 1, *pl. 271.* 1829, whose type species is the moss now known as *Platygyrium repens* (Brid.) Bry. Eur., with which *Leskea tristis* Cesati is not congeneric. The species placed in *Haplohymenium* by Brotherus, l. c. apparently do not properly belong in *Anomodon* but the nomenclature is so tangled that action of an international committee seems necessary to settle the matter. The author accordingly hesitates to add to the confusion by proposing a new generic name.

KEY TO THE LESKEACEAE.

1. Costa short or double or both ..... 2.
   Costa strong, reaching the middle of the leaf at least ..... 4.
2. Stem leaves subclasping, cordate, decurrent, erect-spreading to spreading-recurved when dry; capsules curved; peristomes perfect ..... *4. Heterocladium.*
   Stem leaves not cordate and clasping, appressed when dry; capsules erect or nearly so ..... 3.
3. Plants dark green; peristomes much reduced, the inner of very short fugacious segments ..... *8. Pterigynandrum.*
   Plants glaucous-green; peristomes perfect ..... *9. Myurella.*
4. Robust plants (except *Anomodon tristis* and *A. rostratus*), without paraphyllia; leaves densely papillose and subopaque; capsules erect and symmetric; peristome with segments narrow and cilia rudimentary or wanting; archegonia on the branches ..... *12. Anomodon.*
   Plants small to robust; paraphyllia mostly present; capsules and peristomes various; archegonia mostly on the stems ..... 5.
5. Leaf cells smooth, strongly serrate; plants very rare ..... *11. Herpetineurum.*
   Leaf cells papillose, or if smooth, leaves not serrate ..... 6.
6. Leaf cells with a single very large papilla, which is sometimes forked; capsules erect and symmetric; peristome imperfect, the inner rudimentary or lacking. *10. Thelia.**
   Leaf cells smooth or with much smaller papillae, 1–5 on each cell ..... 7.
7. Plants with abundant filiform paraphyllia, which are usually branched; capsules curved, peristomes perfect ..... 8.
   Paraphyllia less abundant (except forms of *Pseudoleskea*); capsules various; peristomes with cilia rudimentary or often lacking (except *Claopodium*) ..... 9.
8. Paraphyllia felted along the stem and attached to the leaf base ..... *2. Helodium.*
   Paraphyllia abundant not felted and not attached to leaf base ..... *1. Thuidium.*
9. Plants not found east of the Rocky Mts.; Thuidium-like, leaf cells papillose; capsules curved and peristomes perfect ..... *3. Claopodium.*
   Plants not Thuidium-like; capsules mostly erect and symmetric or nearly so; leaves smooth or papillose; peristomes mostly imperfect, the inner sometimes entirely lacking ..... 10.
10. Plants of elevated and northern regions, occurring mostly in the Rocky Mts. and westward; leaves with strongly recurved to revolute margins; capsules mostly inclined and unsymmetric; segments of inner peristome lanceolate, partially developed cilia usually present ..... *5. Pseudoleskea.*
    Plants growing mostly east of the Rocky Mts., some extending to the Gulf; leaf margins less strongly recurved; capsules mostly erect and symmetric; segments of inner peristome linear or wanting; cilia rudimentary or entirely lacking ..... 11.
11. Leaves ovate-lanceolate, acuminate, spreading to squarrose when moist, with plane margins; peristome teeth blunt; inner peristome of a scarcely perceptible basal membrane ..... *7. Lindbergia.*
    Leaves ovate to broadly ovate-lanceolate, obtuse to acuminate, erect-spreading when moist; peristome teeth slender-pointed; segments linear in most species ..... *6. Leskea.*

Family HYPOPTERYGIACEAE.

Plants slender to robust; main stems rhizome-like; secondary stems mostly simple below and pinnately branched or *dendroid above;* branches densely and complanately foliate, *with a row of much smaller appressed leaves on the ventral side* (amphigastria of authors); leaves two-rowed, unsymmetric, ovate to oblong, mostly bordered; costa simple, constructed of homogeneous cells; leaf cells parenchymatous, mostly smooth, alar not differentiated; archegonia borne on secondary stems and their branches. Capsules exserted, seldom erect, mostly symmetric; exothecial cells collenchymatous; peristome perfect or lacking cilia or teeth or both; calyptra naked. Mostly tropical and subtropical.

* See Lindbergia.

HYPOPTERYGIUM Brid. Bry. Univ. 2: 709. 1827.

Leaves with costa ending well below apex; seta well developed; peristome perfect, with cilia.

HYPOPTERYGIUM JAPONICUM Mitt. Journ. Linn. Soc. 7: 155. 1864.

Hypopterygium canadense Kindb. Rev. Bryol. 28: 46–48. 1899.

Plants light green; secondary stems unbranched for a greater or less distance below, pinnately and complanately branched above, reaching two or more cm. in height; leaves of secondary stems ovate, gradually short-acuminate, bordered, sharply serrate above; branch leaves broadly ovate, short-acuminate, ± 1.5 mm. long; costa extending ¾ length; ventral leaves smaller, rounded-ovate; median leaf cells rhombic-ovoid, ± 18 μ wide, about 2 : 1. Dioicous; fruit unknown in America.

ILLUSTRATIONS:—Bryologist, l. c. *pl. 9; Pl. 66.*

Queen Charlotte Island off the coast of British Columbia (Newcombe) (the type of *H. canadense* Kindb.); on rocks among boulders, Egg Harbor, Coronation Island, about 55° N. Lat., A. S. Foster.

The occurrence of this Japanese species in such an unexpected region is probably explained by the Japan Stream. (See Holzinger, Bryol. 17: 44. 1914.)

Family HOOKERIACEAE.

Plants of *soft, often succulent texture*, small to large, often complanate-foliate; stems mostly without central strand, without paraphyllia or stolons; leaves often margined by narrower cells; *leaf cells smooth, thin, pellucid, mostly parenchymatous, alar not differentiated;* costa lacking or single, occasionally double and reaching beyond leaf middle. Archegonial branch small, with few leaves; capsule exserted, inclined to horizontal, exothecial cells often collenchymatous; seta smooth or rough; peristome double, with cilia often lacking or rudimentary; calyptra conical, mitriform, entire, lobed or laciniate, smooth, papillose or hairy.

KEY TO GENERA.

1.	Leaves ecostate, scarcely bordered	*1. Hookeria.*
	Leaves with double costa reaching leaf middle or farther	2.
2.	Leaves bordered; double costa reaching the leaf middle; leaf cells smooth	*2. Cyclodictyon.*
	Leaves not bordered; double costa nearly reaching apex; leaf cells papillose	*3. Callicostella.*

1. HOOKERIA Sm. in Trans. Linn. Soc. 9: 276. 1808.

Plants large, in wide flattened mats, soft, light green, turning whitish when dry; stems more or less complanately foliate, leafy stems reaching 1 cm. in width; leaves large, soft, ecostate, ovate to ovate-oblong, entire. Seta smooth; capsules inclined to subpendulous; capsule short, ovoid; operculum rostrate; annulus usually present; peristome without cilia. Type species *H. lucens.*

KEY.

Leaves obtuse; plants of the West Coast	*1. H. lucens.*
Leaves acute; plants found east of the Mississippi valley only	*2. H. acutifolia.*

1. HOOKERIA LUCENS (L.) Sm. l. c.

Pterygophyllum lucens Brid. Musc. Recent. Suppl. 4: 149. 1819.

Stems 3–6, or even 10 cm. long; central strand present; leaves complanate, imbricated, little changed in drying, *broadly oval, obtuse*, entire, about 4 mm. long, somewhat decurrent; the dorsal symmetric, the lateral somewhat unsymmetric; median leaf cells oblong-hexagonal, and quite regular, 50–60 μ wide, 2–3 : 1, thin-walled; marginal somewhat longer and narrower; perichaetial leaves few, narrower and much smaller. Autoicous; seta reddish yellow, 1.5–3 cm. long, bent at the top; capsules ovoid to oblong-ovoid, horizontal to pendulous; urn 1.5–2 mm. long; operculum long-rostrate from a high conical base, about ⅔ the length of the urn, exothecial cells somewhat collenchymatous; stomata numerous in the short neck; calyptra mitrate, scarcely longer than the operculum; peristome perfect hypnaceous except for the lack of cilia, outer basal plates of teeth with fine transverse lines; inner peristome about as long as the outer, with basal membrane more than ⅓ its height; spores autumn to early winter. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 448; Pl. 59.*
EXSICCATI:—Grout, N. Am. Musci Pl. 16 & 16a; Allen, Mosses Cascade Mts. 88.
On moist shaded ground and stones, occasionally on logs; California to Vancouver Island west of the Rockies.

2. HOOKERIA ACUTIFOLIA Hook. in Schwaegr. Suppl. 2^2: 36. *pl. 163.* 1826.*

Pterygophyllum lucens Sull. Musc. Allegh. 58. 1846; not Bridel 1819.
Hookeria Grevilleana Griff. Not. Pl. Asiat. 473. 1849.
Hookeria ? Sullivantii C. Muell. in Lesq. & James Manual 293. 1884.
Pterygophyllum acuminatum Paris, Index Bryol. (Ed. 1) 4: 1051. 1898.

In gross appearance closely resembling the last; leaves about the same length, *narrower, oblong-ovate, acute;* leaf cells about the same. Dioicous; antheridia in small buds at base of stems; seta 1–2 cm. long; capsule inclined to subpendent, more or less unsymmetrical, urn 1–2 mm. long; operculum rostrate, sometimes equaling the urn; annulus lacking; spores rarely produced, probably in winter. Type locality, Nepal, India (Hooker).

ILLUSTRATIONS:—Mem. Torr. Bot. Club 4: *pl. 80; Pl. 58.*
EXSICCATI:—Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 270, (Ed. 2) 401; Grout, N. Am. Musc. Pl. 311.
In cool springs and banks of streams on soil and damp stones. Ohio to Pennsylvania and Connecticut, south to N. Carolina and Georgia. Also India, Ceylon and Java; West Indies and South America.

2. CYCLODICTYON Mitt. Journ. Linn. Soc. 7: 163. 1864.

Type species *C. laetevirens* (Hook. & Tayl.) Mitt. We have only 1 species.

CYCLODICTYON VARIANS (Sull.) Broth. Engler & Prantl, Musci (Ed. 1) 935. 1907.

Hookeria varians Sull. Proc. Am. Acad. Sci. 5: 285. 1861.

Plants closely intertangled in rather thin mats, light to yellowish green; stems and branches complanate-foliate, leafy stems 2 mm. wide; leaves ovate to ovate-lanceolate, *rather gradually narrowed to a short, slender acumination,* soft, pellucid, somewhat shrivelled in drying, 1.5–1.8 mm. long; median leaf cells oblong-hexagonal, *smooth,* ± 35 μ wide, 1.5–2 : 1, with a border of a single row of long narrow cells ± 8 μ wide; margins entire or sinuate-serrulate, plane; *costa double, the limbs widely spreading and reaching the leaf middle.* Polygamous; seta reddish, light above and darker below, *smooth,* 1.5–2 cm. long; capsule oblong to ovoid, inclined to horizontal, with a short neck; urn ± 1 mm. long; operculum conic-apiculate; peristome perfect except cilia lacking, *teeth with a light divisional line between the two rows of outer plates in their lower ⅔,* segments markedly papillose; calyptra smooth, very persistent; spores in early winter. Type locality, Cuba, Plantae Cubensis (*Wright*) 88. Type at Harvard. *Pl. 58.*

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 536; Grout, N. Am. Musc. Pl. 244.
On moist decaying wood and humus; peninsular Florida, not common.

3. CALLICOSTELLA (C. Muell.) Jaegr. & Sauerb. St. Gall. Nat. Gesell. (Adumb. 2: 255). 1874–1875.

Hookeria Sect. *Callicostella* C. Muell. Syn. 2: 216. 1850 (in part).

We have only one species, known from Florida only. There are 90 known species, chiefly tropical. Type species *C. incurva* Hook. & Grev.

CALLICOSTELLA SCABRISETA (Hook.) Jaegr. & Sauerb. l. c. (*C. scabrida* Mrs. Britton, Bryol. 21: 28. 1918.)

Hookeria scabriseta Hook. Musc. Exot. *pl. 52.* 1818–1820.
Hookeria cruceana Lesq. & James Man. 292. 1884.†

The smallest member of the family in our range. Plants dark green, irregularly branched; stems and branches complanate-foliate, with leaves less than 2 mm. broad, obtuse; *leaves subcrispate when dry, lingulate to ovate-lingulate,* ± 1.2 mm. long, *abruptly rounded and apiculate at the apex,* dorsal and ventral nearly

* See Bryologist 10: 100–101. 1907.
† Both Mitten, Journ. Linn. Soc. 12: 349 and Brotherus in Engler & Prantl, Musci (Ed. 2) 2: 239, say that *C. cruceana* (Duby) Jaegr. & Sauerb. has a smooth seta. Mr. Williams is of the opinion that N. American specimens labeled *C. cruceana* are either *C. scabriseta* or *C. Merkelii* Hsch.

symmetric, *the lateral often strongly unsymmetric;* margins plane, serrulate above by projecting cell angles; *costa strong and double, the limbs diverging* and *reaching nearly to apex, often toothed at the upper end;* upper leaf cells oblong-hexagonal, ± 10 μ wide, 1.5–2 : 1, each with a single papilla over the lumen; basal cells larger, reaching 50 μ in length, pellucid; perichaetial leaves much narrower. Seta, reddish, 5–7 mm. long, *rough throughout* with broad rounded papillae; calyptra smooth, conical, deeply lobed or laciniate at base; capsule small, ovoid to oblong, with a short neck, more or less inclined; urn about 0.8 mm. long; operculum ½ the length of capsule; peristome teeth strongly ridged horizontally between the plates and with a wide *subhyaline longitudinal line between them;* spores in winter. Type locality, "Caripe," northern Venezuela. Type in Hooker Herbarium at Kew? *Pl. 58.*

Exsiccati:—Grout, N. Am. Musc. Pl. 268; Musci Perfecti 246.
On peaty banks and rotten logs in damp shaded places; Florida, infrequent and local.

Family NECKERACEAE.

Primary stems creeping and defoliate; secondary erect, horizontal or pendent, irregularly to pinnately branching, usually complanately foliate; paraphyllia mostly lacking; leaves usually large, ovate-lanceolate, lingulate or cultriform, acute, obtuse or apiculate, ecostate or with a slender costa; leaf cells smooth, short-rhombic to linear, quadrate to roundish on the margins; antheridial and archegonial buds on the secondary stems. Calyptra cucullate, smooth or hairy; capsule immersed or emergent, rarely with a seta longer than the perichaetium, erect and symmetric or nearly so; peristome single or double.

Key.

1. Leaves ecostate, auricled on one side as in the hepatic *Radula;* sterile only, in this country ..... *2. Homalia Sharpii.*
   Leaves not auricled on one side ..... 2.
2. Capsule on a long seta; leaves cultiform, not undulate, costate to above the middle ..... *2. Homalia Jamesii.*
   Capsule immersed or exserted on a very short seta; (except *Neckera complanata*); leaves often undulate, costate or ecostate ..... *1. Neckera.*

1. NECKERA Hedw. Fund. 2: 93. 1782. & Sp. Musc. 200. 1801.

Eleutera P. B. Prodr. 30. 1805.

Primary stems creeping, often stoloniferous and bearing very small leaves; secondary stems erect to pendent, closely foliate, pinnately or bipinnately branched, stems and branches often flagelliform at the ends; leaves complanate (except *N. gracilis*), often transversely undulate, ovate-lanceolate to oblong or lingulate, frequently unsymmetric; leaf cells mostly incrassate, short and rounded near the apex, linear to linear-oblong near the base; capsules immersed to emergent, or long-exserted, erect and symmetric, ovoid to oblong; operculum more or less rostrate; peristome double, the inner a short membrane with 16 more or less well-developed segments, cilia lacking. Plants usually growing on trees or rocks. Type species, *Neckera crispa* (L.) Hedw.

Key.

1. Leaves acute to acuminate, or apiculate; costa various; plants of the mountains and the North ..... 2.
   Leaves very obtuse, truncate, costate to near the apex; known in our range from Florida only (*Neckeropsis* Reichdt.) ..... 8.
2. Leaves ecostate or nearly so ..... 3.
   Leaves with costa reaching the middle or beyond ..... 7.
3. Leaves rounded and usually apiculate at the apex ..... 4.
   Leaves acute to acuminate, strongly undulate ..... 6.
4. Leaves undulate ..... *1. pennata* var. *oligocarpa.*
   Leaves not undulate ..... 5.
5. Plants moderately robust; leaves complanate ..... *2. complanata.*
   Plants very slender, filiform; leaves not complanate ..... *3. gracilis.*

6. Leaves entire or slightly denticulate above ..... *1. pennata.*
   Leaves with numerous very slender sharp teeth above ..... *4. Douglasii.*
7. Plants very robust, reaching 10 cm. or more in length, frequent in the Northwest and fruiting freely ..... *5. Menziesii.*
   Plants much smaller, 2–3 cm. long, fruit unknown, known from one locality in New Mexico only ..... *8. neomexicana.*
8. Leaves transversely undulate when moist ..... *7. undulata.*
   Leaves not transversely undulate when moist ..... *6. disticha.*

1. NECKERA PENNATA (L.) Hedw. Stirp. Crypt. **3**: 17. 1792 & Sp. Musc. 200. 1801.

Eleutera pennata Stuntz Bull. Torr. Bot. Club. **27**: 205. 1900.

Plants rather large, bright to yellowish green; secondary stems horizontal to pendent, 5–10 cm. long, with branching irregularly pinnate; leafy stems 4–5 mm. wide; branches usually obtuse; leaves and branches in the same plane; leaves complanate, spreading, undulate, ovate-lanceolate, acute to acuminate, unsymmetric, 2–2.5 mm. long; margins plane or one incurved at base, entire or slightly denticulate above; costa lacking or faint and short, single or forked; median leaf cells linear-flexuose, ± 7 μ wide, 5–8 : 1, at apex shorter and broader, rhomboidal, at basal angles irregularly quadrate to subrectangular, pellucid or colored; perichaetial leaves long-sheathing, the inner long-acuminate, longer than seta and capsule. Autoicous; seta shorter than the capsule; capsule oblong-ovoid, urn about 2 mm. long, red-brown; operculum conic, short rostrate; peristome teeth narrow, sometimes irregularly divided or clinging together at the tips; segments short and imperfect; calyptra hairless; spores spring to summer, usually produced abundantly.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 440;* M. H. M. f. 215.

EXSICCATI:—Drumm. Musc. Am. 161; Sull. Musc. Allegh. 76; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 266, (Ed. 2) 392; Aust. Musc. Appal. 255; Grout, N. Am. Musc. Pl. 11; R. & C. Musc. Am. Sept. 188.

Mainly on trunks of deciduous trees in cool moist woods, occasionally on ledges or cliffs. Rather frequent in the East; North Carolina to southern Canada, infrequent west of the Mississippi. Reported by Macoun from Manitoba.

Var. OLIGOCARPA (Bruch) Grout, M. H. M. 394. 1910.

Neckera oligocarpa Bruch in Hartm. Skand. Fl. (Ed. 5) 338. 1849.

More slender; leaves lingulate to somewhat ovate at base, mostly abruptly rounded and apiculate at apex, which is usually finely and regularly serrulate, ± 1.2 mm. long.

ILLUSTRATIONS:—Bry. Eur. *pl. 441;* M. H. M. *f. 216.*

EXSICCATI:—Aust. Musc. Appal. Suppl. 528; Grout, N. Am. Musc. Pl. 265; Sull & Lesq. Musc. Bor. Am. (Ed. 1) 268 (as *N. chlorocaulis*), (Ed. 2) 393.

It is rather difficult to determine how the European forms of this species and variety compare with the American. Cardot's Musci Europ. Exsic. represents exactly the author's idea of the variety and matches very closely N. Am. Musci. Pl. 265. Typically, so far as appears, the variety is *slender with leaves which in outline much resemble* those of *N. complanata*, from which the undulate leaves and immersed capsule easily distinguish it. Specimens which are typically *pennata* in other respects have attenuate branches, and specimens otherwise characteristic of var. *oligocarpa* lack them. Specimens of *pennata* are occasionally as slender as the variety.

The variety *oligocarpa* in a robust form approaching forma *pterantha* has been collected by Bartram (Mosses of Southern Arizona 165, as *N. pennata*), and in New Mexico by Fendler. The variety ranges north in the Rocky Mts. through Colorado and into Canada, eastward with the range of the species. All the specimens examined grew on rocks.

The western plants are more robust, about the size of the eastern *pennata*. The shape of the leaf apex is about the only distinction between *pennata* and its var. *oligocarpa* and this character varies greatly in N. America.

Var. OLIGOCARPA forma PTERANTHA (C. M. & Kindb.) **n. comb.**

Neckera oligocarpa var. *pterantha* Kindb. in Herb. Can. Geol. Survey.

Neckera pterantha C. M. & Kindb. in Macoun Cat. Can. Pl. **6**: 162. 1892.

"Secondary stems nearly simple, about (up to) 1 dm. in length, rigid and robust, erect; one branch of costa often reaching to the middle of leaf; paraphyllia numerous; capsule emergent." (Stuntz, l. c.). Leaves reaching 2 mm. in length.

Type locality, rocks, Hector, B. C., the only locality from which it has been collected.

Exsiccati: Macoun, Can. Musci, 104, 494, 616.

2. Neckera complanata (L. Hedw.) Hueben. Musc. Germ. 576. 1833.

Leskea complanata Hedw. Fund. **2**: 93. *pl. 10, f. 62–65.* 1782 and Sp. Musc. 231. 1801.
Eleutera ornithopodioides (Scop. 1760) Stuntz. l. c. 209.

Plants about the size (secondary stems 2–4 cm. long) and appearance of *N. pennata oligocarpa* and with cell structure and outline of leaves very similar; but the leaves are *not at all undulate* and the upper leaf cells are more regular, almost exactly rhombic and there are often lanceolate paraphyllia in the axils of the branches, which are often flagelliform. Dioicous; *seta 7–10 mm. long, much longer than the perichaetium;* operculum ½ the length of urn or longer; spores in spring. Type locality European.

Illustrations:—Bry. Eur. *pl. 444;* M. H. M. *f. 217.*
Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 267; (Ed. 2) 396; Grout, N. Am. Musci Pl. Suppl. 44.
On rocks and trunks of trees in cool shaded places. Rare and subalpine. Mountains of Pennsylvania, NewEngland and eastern Canada; north to Labrador. Tennessee, Sull. & Lesq. l. c.
Considerable herbarium material labeled *N. complanata* is *N. pennata* var. *oligocarpa*, due to the fact that most American *complanata* is depauperate and sterile and the leaves have a similar outline. But the non-undulate leaves are a certain and easy distinction. All American material is sterile.

3. Neckera gracilis (James) Kindb. Europ. & N. Am. Bryin. **1**: 18. 1897.

Homalia gracilis James, Rep. Reg. N. Y. Univ. **22**: 57. 1869.

Plants exceedingly small, slender, irregularly but freely branching, filiform; stems and branches mostly flagelliform at the ends, the larger stems somewhat complanate-foliate, with the leaves a little more than 1 mm. wide, bearing oblong-lingulate leaves about 0.7 mm. long, not undulate, rounded-obtuse or apiculate, slightly serrulate at apex; costa very short and often double; upper leaf cells rhomboidal, ± 8–12 μ wide and a little longer; basal longer in the median region, smaller at the margins; sporophyte unknown. Type locality, New York.

Illustrations:—Sull. Icones Musc. Suppl. *pl. 25; Pl. 62.*
Exsiccati:—Aust. Musc. Appal. 257; Grout, N. Am. Musc. Pl. 138.
On rocks, usually in elevated regions, New Jersey, New York and Vermont.

4. Neckera Douglasii Hook. Bot. Misc. **1**: 131. *pl. 35.* 1830.

Eleutera Douglasii (Hook.) Stuntz, l. c. 204.

Plants in loosely intertangled masses, often pendent, yellowish or whitish green; secondary stems 10–20 cm. long, with leaves reaching 5 mm. wide, distantly and irregularly branched; branches long, slender and attenuate; leaves of secondary stems complanate, strongly undulate, oblong to oblong-lanceolate, rather abruptly contracted near the apex to a broad short and *spinose-dentate acumination* (sometimes almost ciliate), somewhat concave with one basal margin broadly inflexed, entire or sinuate-serrulate below, reaching 3 mm. in length; costa faint, short and usually double; branch leaves narrower and more slenderly acuminate, those at the ends of the attenuate branches lanceolate, long and narrowly acuminate, bearing near the apex spinose teeth, which are often recurved and 30–50 μ in length; median leaf cells linear-flexuose, rather thick-walled, 5–6 x 50–75 μ; those at the base shorter, somewhat porose and often colored; inner perichaetial leaves as long as the seta or even longer, often reaching the middle of the capsule, filiform-acuminate, spinose-serrate above. Dioicous; seta ± 6 mm. long; capsule ovoid to oblong, light to dark brown; urn ± 2 mm. long; operculum rostrate, beak as long as the rest of the operculum; peristome teeth slender, reaching 0.4–0.5 mm. in length; segments very slender, almost as long as the teeth, from a conspicuous basal membrane; annulus lacking; spores in winter. Type locality, northwest coast of N. America (Menzies and others) on bark and trunks of trees near the Columbia River. *Pl. 60.*

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 394; Grout, N. Am. Musci Pl. 56, Musci Perfecti 233; Allen, Mosses Cascade Mts. 84; R. & C. Musc. Am. Sept. 77 & 77b.
On rocks and trunks of trees, San Mateo, California to Alaska, east to Colorado and Idaho.
The spinose-dentate leaf apices enable one easily to distinguish this species from all others.

5. NECKERA MENZIESII Hook. in Drumm. Musc. Am. 162. 1828.

Eleutera Menziesii Stuntz, l. c. 207.

Plants robust, dark to yellowish green, in rather loose masses; secondary stems 10–20 cm. long, rather regularly pinnately branched in one plane; branches often slender and attenuate, sometimes with still more slender branchlets pinnately arranged, branches and branchlets often flagelliform at the ends and frequently with abundant lateral flagella; *stems and branches clothed with abundant lanceolate serrulate paraphyllia;* all leaves strongly undulate, those of the secondary stems and main branches reaching 3.5 mm. in length; oblong-lingulate, rounded and apiculate at apex, concave; margins narrowly revolute below, at least on one side, finely serrulate above, often with *a few slender paraphyllia attached to the basal angles;* leaves of the flagellate branchlets ovate-lanceolate, acute to acuminate; costa well developed, reaching ¾ the length of the leaf; median leaf cells linear, incrassate, porose, ± 7 μ wide, 30–50 μ long; apical much shorter, oblong to rhomboidal; basal shorter, more incrassate and often colored, at basal angles a few very small subquadrate cells; perichaetial leaves longer than seta and capsule, gradually tapering to a slender ± denticulate point. Dioicous; seta shorter than the capsule, which is oblong-ovoid, brown, urn ± 2.5 mm. long; operculum long-rostrate, about ½ the length of urn; annulus lacking; peristome teeth slender, ± 0.3 mm. long; segments linear from a narrow basal membrane, as long as the teeth, open between the articulations; spores rough, ripening in winter? Type locality, Rocky Mountains (Menzies).

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 62; Pl. 61.*

EXSICCATI:—Drumm. l. c.; Grout, N. Am. Musci Pl. 18; Allen, Mosses Cascade Mts. 85; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 395.

On rocks and trunks of trees; California, Idaho, Montana, and northwards to Alaska.

Var. LIMNOBIOIDES R. & C. Bot. Centralbl. **44**: 422. 1890.

"Plants small, caespitose, soft and dilated, brownish-green; secondary stems but 1–2 cm. in length; habit of a *Limnobium* (*Hygrohypnum*); no flagella." (Stunz, Bull. Torr. Bot. Club **27**: 208.)

Type locality, Mt. Hood, Oregon; also rocks, Cascades, Easton, Washington.

6. NECKERA DISTICHA Hedw. Stirp. Crypt. **3**: 58. *pl. 22.* 1794, & Sp. Musc. 201. 1801.

Plants pale green, in loose tufts; secondary stems reaching 5 cm. or more in length, about 3 mm. wide at base, irregularly pinnately branching, with few branches, both stems and branches complanately foliate and attenuate; leaves of stem and larger branches not crowded, somewhat shrunken in drying, *not transversely undulate;* lingulate, *very unsymmetric and subclasping at base, at apex rounded-obtuse, truncate or slightly emarginate,* reaching 2 mm. in length, usually shorter; margins plane, entire or very finely toothed at apex; costa slender but distinct, reaching ± ⅕ the length of the leaf, often forking near the end, *at the base twice as far from one margin as the other;* upper leaf cells near end of costa varying greatly in shape and size, irregularly subrectangular to oval-rhombic, ± 7 μ wide and rather less than 2 : 1, gradually increasing in length towards the base; median basal linear, reaching 10 μ in width, 4–8 : 1, all marginal cells smaller; at basal angles a few much smaller cells. Synoicous; capsule and seta very short, about the length of the long linear-acuminate, serrulate perichaetial leaves, sometimes longer sometimes shorter; calyptra naked; capsule oblong to oblong-cylindric; urn reaching 1.2 mm. in length; annulus lacking; operculum a little less than ½ the length of urn, conic-rostrate, oblique; peristome teeth linear, very rough; segments very narrow, as long as the teeth, basal membrane very narrow or lacking; spores in winter. Type locality West Indies; *Pl. 60.*

EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 530 (some specimens contain an *Entodon*); Grout, N. Am. Musci. Pl. 478.

On trees and bushes, peninsular Florida, rare. Also in tropical America from Mexico to South America.

7. NECKERA UNDULATA Hedw. l. c. 51. *pl. 21.* & Sp. Musc. 201. 1801.

Eleutera jamaicensis (Gmel.) Stuntz, l. c. 210.

Plants a little more robust than the last, leafy stems about 4 mm. wide; secondary stems 3–5 cm. long, rather sparingly branched in Florida specimens; leaves about the same size and shape as in the last and costa about the same, *but all leaves strongly undulate transversely;* leaf cells about the same, much less regular than shown in *Pl. 61;* inner perichaetial leaves long-linear acuminate, toothed above, *longer than the very short*

seta and capsule. Synoicous; *calyptra with a few hairs;* capsule short-oblong to oblong-ovoid, urn between 1.2 and 1.5 mm. long; operculum rostrate, more than ½ the length of urn; annulus lacking; peristome much as in the last but more regular and the teeth smooth; spores in spring.

Type locality Jamaica, W. Indies.

Illustrations:—Hedw. l. c.; Engler & Prantl (Ed. 2) Musci **2:** *f. 571.* p. 187; *Pl.* 61.
Exsiccati:—Aust. Musc. Appal. Suppl. 1, 529; Grout, N. Am. Musci Pl. 230.
On trees and shrubs, peninsular Florida, Texas; also in Mexico and tropical and subtropical America; widely distributed. The Florida plants appear to be smaller than some of the tropical material.
The plants appear more robust than in *N. disticha,* largely because the leaves spread at a wider angle. The Lesq. & James Manual says "teeth and peristome nodulose, punctulate," but this is not true of some thoroughly matured specimens from Florida but does appear to be true of some S. American material.

8. Neckera neomexicana (Card.) n. comb.

Porothamnium (?) neomexicanum Card. Rev. Bryol. **37:** 8. 1910.

Plants soft dull green; secondary stems 2–3 cm. long; branching irregularly pinnate, branches complanate-foliate, obtuse or attenuate; leaves oblong, more or less unsymmetric, not undulate, broadly and shortly acuminate, acute or even subobtuse, minutely denticulate above or entire, concave, somewhat decurrent; lower margins subundulate and often reflexed, then more or less revolute, sometimes nearly plane on one side; costa rather thin, extending to the middle of the leaf or a little farther; upper leaf cells rhomboidal to oblong-hexagonal, median varying from ovate to oblong and linear, about 12 μ wide, 2.5–5 : 1; alar cells minute, quadrate or roundish; perichaetial leaves convolute, long-acuminate, ecostate; sporophyte lacking. Type locality Mt. Mogallan, near the west branch of the Gila River, Socorro Co., New Mexico (O. B. Metcalf, 1903). Type in Cardot Herbarium at Paris; cotype in herbarium A. J. G. *Pl. 60.*

The affinities of this species will remain uncertain until the mature sporophyte is found. Brotherus wrote the author that he was sure it was a *Porothamnium* rather than a *Neckera.* Cardot at first referred it to *Neckera.* With this earlier opinion the author agrees.

2. HOMALIA (Brid.) Bry. Eur. fasc. 44–45. 1850.

Omalia Brid. subgenus of *Leskia* Brid. Bryol. Univ. **2:** 325. 1827.

Habit, appearance and leaf structure of *Neckera;* leaves not undulate, sometimes with an incurved oblong lobe on one side of the base; capsule on a long slender seta, mostly erect and symmetric; peristome teeth marked with fine transverse lines on the outer plates at base as in *Hypnum,* inner peristome with a well developed basal membrane, keeled segments and cilia rudimentary or wanting.

Key.

Leaves costate to above middle, no basal lobe..... *1. Jamesii.*
Leaves ecostate, with basal lobe..... *2. Sharpii.*

1. Homalia Jamesii Schimp. Coroll. 100. 1856.

Homalia trichomanoides of the Lesq. & James Manual, 285. 1884; *not* of Bry. Eur.
Homalia Macounii C. M. & Kindb. in Macoun, Cat. Can. Pl. **6:** 163. 1892.

Plants loosely tufted or straggling, shining yellow-green; primary stems slender, stoloniferous with very small leaves, secondary stems slender, reaching 1.5 cm. in length, often short, irregularly branching, complanate-foliate; leaves oblong-cultriform, rounded-obtuse, somewhat curved towards the ventral side, minutely serrulate above, usually less than 1.5 mm. long; costa slender, reaching the middle of the leaf or beyond; lower median leaf cells linear-fusiform, about 7 μ wide; apical and marginal cells broadly rhomboidal, scarcely broader than long. Monoicous; seta slender, red, 1–1.5 cm. long; capsule oblong-cylindric, urn a little more than 1 mm. long erect and symmetric; operculum rostrate; annulus present; peristome as described for the genus; spores in autumn. Type locality, North American, Catskill Mts.?

Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 397; Aust. Musc. Appal. 256; Grout, N. Am. Musc. Pl. 37 & 232. Drumm. Musc. Am. 171 (As *H. trichomanoides*).
On moist shaded cliffs and ledges, especially in crevices, in cool elevated regions, Pennsylvania to Newfoundland, west to Washington and British Columbia: frequent but local.

It is very doubtful if the North American plant should be considered distinct from the European; the only constant difference the author has been able to note, is that the leaves in the European plant have a tendency to be somewhat apiculate while the American are rounded-obtuse. The distinctions given in the Lesq. & James Manual are either wanting or insignificant. Limpricht gives the length of leaves in the European plamt as 1.8–2 mm. but in a number of English and continental plants the leaves were no larger than in the American. (M. H. M. *f. 214.*)

2. Homalia Sharpii Williams, Bryol. **34**: 20. *pl. 2.* 1931.

"Evidently dioicous; plants with trailing stems 4–5 cm. long, bearing scattered radicles and crowded, more or less erect branches 1 to 2 cm. high, often divided above into short complanate branchlets; branch leaves complanate, ecostate, mostly not quite symmetric, from a narrow base broadly ovate to rotundate above, about 0.6 to 1.2 mm. long, the borders entire or slightly crenulate and flat except at one side of base where they mostly become incurved or bear an oblong lobe sometimes nearly one-third the length of the leaf; leaf cells mostly with thickened walls and rounded angles, the apical cells from roundish or square to short-oblong, about 6 μ by 6–8 μ, and small short cells extend in the border to the base on one side, the longer cells extending down the middle of the leaf in a rather distinct band, with cells up to 8 μ wide and 30–50 μ long, near base with often pitted walls; perichaetial leaves mostly narrowly oblong or spatulate, the larger about 0.8 mm. long, sometimes with acute apex but mostly broadly rounded above and irregularly serrate often one third way down, enclosing 6–8 archegonia with few, slender paraphyses." *Pl. 65.*

"Type collected on face of rocky ledge, near Agee, Campbell Co., Tennessee, at 1300 ft. by A. J. Sharp, March 20, 1930."

"This species is nearest *H. Targioniana* of India but is a smaller plant, with perichaetial leaves not half as long and more serrate."

The above is quoted from the original description. Mr. Sharp has sent the author sufficient material from the type locality for issue in N. Am. Musci Pl. Suppl. No. 42.

The discovery of this near relative of Asiatic species is one of the most interesting of recent bryological discoveries in North America. The Japanese *Hypopterygium* and the Himalayan *Claopodium pellucinerve* on the West Coast are not so hard to understand as the Asiatic *Herpetineurum* in Georgia and *Homalia Sharpii* in Tennessee, so closely allied to Asiatic forms.

Family METEORIACEAE.

Plants slender to moderately robust; primary stems creeping, filiform; secondary stems mostly pendent, mostly distantly and irregularly pinnate, in some cases almost regularly pinnate, complanate-foliate or with leaves equally spreading on all sides; paraphyllia lacking; leaves mostly symmetric, short- to long-acuminate; costa mostly single and slender, seldom double or lacking; leaf cells prosenchymatous, looser at base, somewhat differentiated at basal angles. Mostly dioicous; archegonial and antheridial buds mostly borne on the branches; seta smooth in our species; capsules mostly small and symmetric; stomata phaneropore; peristome double, of the *Neckera* or *Hypnum* type; opercula mostly rostrate.

Key to Genera (of our N. American forms).

1. Leaves squarrose-spreading, not papillose ..... *3. Meteoriopsis.*
   Leaves loosely spreading, papillose ..... 2.
2. Leaves strongly auriculate ..... *1. Tricholepis.*
   Leaves not auriculate ..... *2. Barbella.*

Papillaria C. Muell. nomen cons.

1. TRICHOLEPIS Kindb. Bot. Centralbl. 77: 52. 1899.

Papillaria C. Muell. Oefv. K. Sv. Vet.-Ak. Förh. **4**: 34. 1876.* (not of Dulac. 1864).

We have one species of this large tropical genus, practically all growing on trees. The leaves are cordate or auriculate at the decurrent subclasping base; costa single and slender; leaf cells with several minute papillae over the lumen; seta smooth; capsules exserted; cilia of inner peristome rudimentary or wanting; calyptra hairy.

* *Papillaria* had been used three times before 1876 for genera not belonging to the Musci. Kindberg puts *Tricholepis* in the *Cryphaeaceae* but still retains *Papillaria* under family *Papillariaceae.* He describes *Tricholepis* thus "Kapsel mit hervorragenden Stiele. Peristome doppelt. Haube behaart. Blätter (trocken) wenig angedrückt." "Founded on *Neckera nigrescens* Schwaegr."

1. TRICHOLEPIS NIGRESCENS (Sw.) **n. comb.**

Pterigynandrum nigrescens Sw. Fl. Ind. Occid. **3**: 1778. 1806.
Neckera nigrescens Schwaegr. Suppl. **3²**: *pl. 244.* 1828.
Meteorium nigrescens Mitt. Journ. Linn. Soc. **12**: 441. 1869.
Papillaria nigrescens (Sw.) Jaegr. & Sauerb. St. Gall. Nat. Gesell. **1874-1875**: 169.

Plants in thin intertangled mats, the newer growth bright to yellowish green, the older darker, often almost black; stems creeping, reaching 10–15 cm. in length, sparingly divided, often regularly pinnately branching with short branches, which are usually 1 cm. or less in length, these branches often producing very short branchlets; leaves spreading when moist, erect-open to appressed when dry, close, somewhat plicate when dry, those of the stems triangular-ovate from a strongly cordate-auriculate base, narrowly acuminate, somewhat concave, ± 1.4 x 1 mm.; margins plane, more or less undulate, nearly entire or finely serrulate at base; costa slender, reaching the middle of the leaf or beyond; leaf cells in the region of the costa linear-flexuose, 6–7 μ wide, 5–8 : 1, at the angles almost quadrate, the greater length of the cells seeming to diverge at an angle from the costa instead of running parallel to it, all, except some of the elongated cells near the costa, with 2 or more minute papillae on each side; branch leaves narrower, broadly ovate-lanceolate, less slenderly acuminate; perichaetial leaves few, about ½ the size of the branch leaves. Seta short ± 6 mm. long; capsule erect and symmetric; urn about 0.5 mm. long, short-oblong or ovoid; operculum "subulate"; calyptra split on one side, bearing a few hairs; peristome double; teeth well developed, segments linear, shorter than the teeth, from a narrow basal membrane; spores rarely produced. Type locality, Jamaica.

ILLUSTRATIONS:—Schwaegr. Suppl. **3²**: *pl. 244; Pl. 63.*
EXSICCATI:—Grout, N. Am. Musci Pl. 229.
Common on trees in peninsular Florida, occurs also in Louisiana. Much of the Florida material is
VAR. DONNELLI (Aust.) **n. comb.** (*Meteorium nigrescens* var. *Donnelli* Aust. Musc. Appal. 533). This is apparently a habitat form, very easily recognized by the more slender branches, denuded of leaves except a small tuft at the very end. This is often mistaken for a sporophyte at first glance.

2. BARBELLA (C. Muell.) Fleisch. Engler & Prantl (Ed. 1) Musci, 828. 1906.

Pilotrichella; section *Barbella* C. Muell. Flora **82**: 464. 1896.

In so far as our species are concerned this genus differs from the last chiefly in its leaves not cordate or auriculate and its narrowly linear leaf cells. Type species *B. trichophora* (Mont.) Fleisch.

BARBELLA PENDULA (Sull.) Fleisch. l. c., 1227. 1909.

Meteorium pendulum Sull. Mosses U. S. 81. 1856.

Plants yellowish green above, brown in the older parts, long filiform, flexuous and pendent, sometimes reaching 15 cm. or more in length; leaves erect-open, those at the base of branches larger, narrowly lanceolate, gradually and slenderly long filiform-acuminate, ± 2 mm. long, subclasping and slightly decurrent; margins plane, serrulate; median leaf cells narrowly linear ± 6 μ wide, reaching 35–40 μ in length, papillose dorsally at least with two or more minute papillae; alar short-rectangular to quadrate, all rather thick-walled; costa reaching the leaf middle. Probably dioicous; seta 2–3 mm. long; capsule ovoid, about 1 mm. long; operculum conic, obliquely short-rostrate; peristome teeth more or less open along the middle line; segments a little shorter, from a low basal membrane.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 73; Pl. 62.*
On trees and bushes, western Louisiana. Also in the East Indies, Japan and China.

3. METEORIOPSIS Fleisch. Musc. Archip. Ind. Exs. n. 235. 1902.

Differs from our other genera of the family chiefly in the squarrose-spreading leaves and smooth leaf cells.

METEORIOPSIS PATULA (Sw., Hedw.) Broth. Engler & Prantl, Musci (Ed. 1) **2**: 825. 1906.

Hypnum patulum Hedw. Sp. Musc. 279. *pl. 73.* 1801.

Plants light green, in loosely intertangled mats; stems creeping, long, reaching 15 cm. or more in length, more or less regularly pinnate with short (3–6 mm.) branches; stem leaves spreading to squarrose, broadly

round-ovate, strongly contracted to the subclasping, slightly decurrent base, rather abruptly acuminate; margins plane entire or minutely serrulate; costa very slender, reaching about to the leaf middle; median leaf cells narrowly linear, about 6 μ wide, 6–10 : 1; basal shorter and broader, with thicker walls and often colored; at basal angles a small group of more or less enlarged, subrectangular cells; branch leaves squarrose-spreading, broadly ovate, more shortly acuminate and more strongly serrate; perichaetial leaves ecostate, reaching to the base of the capsule. Capsule ovoid-cylindric, symmetric; operculum subulate-rostrate; peristome teeth narrow, segments narrow, as long as the teeth, from a narrow basal membrane; calyptra somewhat hairy. *Pl. 57.*

Collected by Dr. Small "in hammocks between Cutler and Longview Camps, Florida, Nov. 1903, no. 1374." A specimen without data except that it was from Florida was sent me by B. D. Gilbert in 1904. Also found in the West Indies, Mexico and southwards into South America to the Amazon.

Plants from Haiti, det. and distributed by Renauld, are scarcely pinnate, the stem leaves are very longly and slenderly acuminate, the acumination as long as the body of the leaf and the margins serrate; the branch leaves are long-acuminate and sharply serrate.

Family PTEROBRYACEAE.

Secondary stems with leaves equally spreading, symmetric; costa single and well-developed to short and double or lacking; leaf cells prosenchymatous, mostly papillose in *Pireella cymbifolia*, looser at base. Mostly dioicous; seta smooth; capsule symmetric, immersed or exserted; stomata few, phaneropore; annulus lacking; peristome teeth normally developed or variously irregularly formed; inner peristome mostly rudimentary, segments lacking, short, or filiform, rarely keeled; opercula apiculate to short-rostrate. So far as our species are concerned the species might well be included in the Meteoriaceae, as capsules seem to be unknown. Both families are mostly tropical or subtropical and Brotherus' classification in the second edition of Engler & Prantl has been followed and the family descriptions adapted from that work. The peristomes in both the genera occurring with us are very imperfect or peculiar, but peristomes are unknown in our species.

Key to Genera.

Leaves squarrose-reflexed ..... *1. Jaegerinopsis.*
Leaves erect-spreading ..... *2. Pireella.*

1. JAEGERINOPSIS Broth. Engler & Prantl, Musci (Ed. 1) **2**: 790. 1906.

Plants moderately robust, growing in loose tufts; secondary stems erect, densely foliate; *leaves squarrose-spreading*, concave, smooth; leaf cells linear; peristome simple, deeply inserted under the mouth, teeth short, blunt and jointed, dorsal layer rough with rounded projections. Type species, *J. Ulei* C. Muell.

Jaegerinopsis squarrosa, E. G. B. Bryol. **21**: 48. *pl. 24.* 1918.

Plants bright green, glossy, climbing on trees; primary stems slender, decumbent and rooting, with small appressed bract-like leaves, which are only .5–1 mm. long, lanceolate-acuminate, ecostate, and entire, or with a short faint costa; secondary stems stout, erect, red, simple and unbranched, 1–2 cm. rarely 4–5, long, rarely tapering off into slender flagellate innovations; leaves crowded, spreading, often with septate propagula in their axils, 1.5–2 mm. long x 1–1.33 mm. wide, rarely wider than long, broadly ovate or cordate, carinate or concave; apex variable, acute or acuminate, serrulate, not subulate, often recurved; margins minutely and obscurely serrulate to base, each marginal cell ending in a small tooth; costa variable, single, and broadest at base, or forking at apex, or rarely double and short, usually extending to less than ½ the length of the leaf, rarely ¾; basal cells largest, irregular and prorose; alar cells slightly different, denser and yellow or brown with thick walls, median and apical cells narrowly linear-vermicular, 27–54 μ long by 2–4 μ wide; all porose and smooth. Dioicous? only female plants known. Archegonia in small lateral buds about 1 mm. long, with acuminate, serrulate, ecostate leaves and few paraphyses. *Pl. 65.*

Type locality: Sierra de las Yeguas, San Diego de los Banos, Pinar del Rio, Cuba, June 28, 1915. Type in herb. N. Y. Bot. Garden, co-type in herb. A. J. G.

On trees. Conspicuous for the squarrose leaves; known only with female inflorescence.

South Slope of Sierra de los Helechales, Banao Mts., Santa Clara, Bros. Leon and Clement, Aug. 1915. Also on Magnolias near Sanford, Florida, S. Rapp. 1917.

Very closely related to *Jagerinopsis scariosum Ltz.* from Panama and perhaps identical, but the leaves

of "*Meteorium scariosum Ltz.*" from Panama are described as being "*shortly bicostate.*" Our specimens from Cuba and Florida are rarely shortly bicostate or they may have the vein forking either at the base or the apex, but usually it is single and ending in the middle of the leaf.

2. PIREELLA Cardot, Rev. Bryol. 40: 17. 1913.

Primary stems creeping; secondary stems 2–4 cm. long, unbranched below and covered with appressed leaves, then thickly branched above with branches mostly in the same plane; lower appressed leaves of the secondary stems ovate, and nearly entire; upper stem and branch leaves strongly costate; median leaf cells linear to oblong, alar often quadrate. Dioicous; capsules mostly immersed, erect and symmetric, ovoid-spheroidal; peristome double, the teeth mostly united in pairs at the top with the bases separate, without lamellae, smooth; inner peristome adherent to the teeth, consisting of a high thin hyaline membrane, which later disappears; operculum small, long-rostrate; calyptra hairy, becoming smooth when old; vegetative reproduction by means of brood bodies common. Growing almost exclusively on trees. Type species *P. cavifolia* (Card. & Herz.) Card.

KEY.

Secondary stems branching rather irregularly, not frondiform; lower leaves of secondary stems not auriculate ..... *1. cymbifolia.*
Secondary stems regularly and complanately branching above, simple below, frondiform; lower leaves of secondary stems auriculate ..... *2. ludoviciae.*

1. PIREELLA CYMBIFOLIA (Sull.) Card. Rev. Bryol. 40: 17. 1913.

Pilotrichum cymbifolium Sull. Mosses U. S. 81. 1856.

Plants in rather straggling patches on trees and shrubs; secondary stems reaching 5 cm. or more in length, almost simple to irregularly and subpinnately branching; branches short, mostly 5–10 mm. long terete-foliate; leaves spirally 5-ranked (according to Sullivant), imbricate; lower leaves of secondary stems broadly oblong-lanceolate, very concave with flat apices, gradually short-acuminate, ± 2 mm. x 0.5 mm., slightly narrowed to the insertion, *subclasping and slightly decurrent but not auriculate,* nearly or quite entire; median leaf cells linear-flexuose, 4–5 x 30–40 μ; basal shorter and broader, often colored, at basal angles a triangular patch of very small quadrate cells (12–20 on the margin), ± 6 μ wide; costa slender but nearly or quite percurrent; branch leaves smaller, more strongly concave, more or less papillose on the back with very fine papillae, serrulate in the upper half; perichaetial leaves much smaller, more slenderly acuminate, ecostate. Sporophyte unknown; apparently reproducing by the septate brood bodies found in clusters in the axils of the leaves. Type locality, Florida; also found in Alabama and Louisiana.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 76; Pl. 56.*
EXSICCATI:—Aust. Musc. Appal. Suppl. 1, 531; R. & C. Musc. Am. Sept. 44.

2. PIREELLA LUDOVICIAE (C. Muell.) Card. l. c.

Neckera ludoviciae C. Muell. Flora 58: 92. 1875.

Differs from the last in the almost regularly pinnate branching of the upper part of the secondary stems, producing a frond-like form; lower leaves of the secondary stems ovate-triangular, strongly auriculate, abruptly long-acuminate; branch leaves with a longer and more slender acumination, nearly entire, little or not at all papillose.

"Capsule elliptic-ovate, erect, tapering at the base, narrowed at the apex, solid, smooth, on a stout minutely roughened pedicel about 12 mm. long; annulus lacking, operculum convex or very short-rostellate; peristome teeth stout and imperfect, linear, hyaline, incurved; calyptra with erect hairs." (Austin, Bot. Gaz. 4: 161. 1879.)

Austin, l. c., states Mueller's diagnosis was on depauperate specimens.

On trees, Florida and Louisiana.

ILLUSTRATIONS:—*Pl. 57.*
EXSICCATI:—Aust. l. c. 532; Cardot, l. c. 78 (according to E. G. B.); Grout, N. Am. Musc. Pl. 227 (as *Pilotrichella cymbifolia*).

The author thoroughly agrees with Mrs. Britton (Bryol. 7: 49. 1904) that this is a good species distinct from *P. cymbifolia.* In fact fairly well-developed plants can be determined at sight. The plants from the Florida Keys and the Everglades and southern peninsular Florida seem to be mostly *P. cymbifolia,* while those from the northern part of the state are mostly *P. ludoviciae.*

Family LEUCODONTACEAE.

Plants rather robust as a rule; primary stems creeping; secondary stems erect, horizontal or drooping, mostly terete-foliate with crowded appressed leaves, simple or branched; paraphyllia mostly lacking; leaves ovate to ovate-lanceolate, often plicate longitudinally, acute to acuminate, mostly entire or nearly so in our species; costa single, double or lacking; leaf cells thick-walled, short and rounded, smooth (except *Leucodontopsis* and *Pseudocryphaea*). Mostly dioicous; capsules erect and symmetric, ovoid to oblong-cylindric, mostly without stomata, immersed to long-exserted; inner peristome rudimentary or lacking, occasionally attached to the teeth; teeth rarely with fine cross striae on the outer basal plates.

Key to Genera.

1.	Costa single	2.
	Costa double or lacking	4.
2.	Leaf cells papillose	2. *Leucodontopsis.*
	Leaf cells not papillose (obscurely so in *Pseudocryphaea*)	3.
3.	Costa percurrent or nearly so; plants found only in Florida within our range, rare	3. *Pseudocryphaea.*
	Costa ending well below apex; plants of the northern U. S.	5. *Leptodon.*
4.	Leaf cells papillose; plants of the West Coast	4. *Pterogonium.*
	Leaf cells smooth; plants of the eastern U. S. and Canada	5.
5.	Secondary stems little branched; calyptra smooth	1. *Leucodon.*
	Secondary stems, freely and often pinnately branched; calyptra hairy	5. *Leptodon.*

1. LEUCODON Schwaegr. Suppl. 1²: 1. 1816.

Main stems long, slender, creeping, almost filiform, with minute leaves and abundant rhizoids; secondary stems numerous, suberect, horizontal or pendent and curved outwards from the substratum, usually julaceous and nearly simple; paraphyllia lacking; leaves of secondary stems many-ranked, concave, with margins recurved below, appressed when dry, spreading when moist, entire or slightly serrate at apex; leaf cells thick-walled, smooth, several rows of basal-marginal cells roundish-quadrate, the lower median linear fusiform, gradually becoming shorter toward the apex, upper marginal short-oblong; basal often colored. Dioicous; calyptra smooth, cucullate, sometimes attached below the capsule by the connate base; capsules exserted or emergent, erect and symmetric, stomata lacking; peristome apparently simple but in some cases of two layers with cell cavities between, rudimentary and scarcely apparent inner peristome often present. Type species *L. sciuroides.*

Key.

1.	Leaves ovate-elliptical, abruptly short acuminate, scarcely plicate when dry	3. *julaceus.*
	Leaves ovate to ovate-lanceolate, gradually longer acuminate, plicate when dry	2.
2.	Secondary stems well developed, rarely with flagella; seta much shorter than the perichaetial leaves	1. *brachypus.*
	Secondary stems usually less developed, shorter and usually bearing numerous flagella; seta much longer than the perichaetial leaves	2. *sciuroides.*

1. Leucodon brachypus Brid. Bryol. Univ. 2: 211. 1827.

Plants in rather loose tufts or patches on trunks of trees, rather dark green above, brown below; secondary stems 5–6 cm. long, sparingly divided or branched, usually drooping and outwardly curved: leaves 1.6–2 mm. long, plicate when dry, more or less secund, especially on the outward curve of secondary stems, ovate to ovate-lanceolate, sharply acute to short-acuminate, often slightly serrulate near apex, ecostate; leaf cells as described for the genus, the median with lumen about 5–6 μ wide, 3–5 : 1, walls a little thinner than width of the lumen; perichaetial leaves loosely appressed-sheathing, longer than the seta. Seta 3–4 mm. long; capsule oblong-ovoid, urn 1.5–2 mm. long, chestnut-colored, small-mouthed; operculum conic-rostrate; peristome teeth somewhat irregular, papillose, often bifid at apex; spores in late autumn or winter. Type from North America.

Illustrations:—Sull. Icones Musc. *pl. 70;* M. H. M. *f. 212 & 213.* (in *f. 212 e represents median and d median basal cells*); Jennings, Mosses Western Pennsylvania. *pl. 31.*

EXSICCATI:—Sull. Musc. Allegh. 86; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 232, (Ed. 2) 351; Aust. Musc. Appal. 261 and 260 (as *L. julaceus*). (See Mrs. Britton in Bryol. **21**: 32); Grout, N. Am. Musci. Pl. 301.

On trees and occasionally on rocks, in woods in cool elevated regions; northeastern U. S. and eastern Canada, south to Georgia, west to Kansas; frequent, but mostly sterile. Occasionally with branches tapering into long slender, more or less hooked tips and bearing small leaves. (Var. *flagellatus* E. G. B. Mem. Torr. Bot. Club **4**: 190. 1894.)

2. LEUCODON SCIUROIDES (L., Hedw.) Schwaegr. Suppl. 1^2: 1. 1816.

Fissidens sciuroides Hedw. Sp. Musc. 161. 1801.

Differs from *L. brachypus* in its smaller size (with few exceptions in N. America); secondary stems rarely over 3. cm. long, frequently producing such large numbers of flagelliform branches near the top as to give the plants a deformed appearance; leaves rarely secund, *very strongly plicate whether wet or dry, longly and slenderly acuminate*, entire (with rare exceptions). Capsules long exserted on a seta about 8–10 mm. long, rather longer than in our other species, urn 2.5–3 mm. long; peristome teeth often widely split along the median line, with cell cavities between the inner and outer plates, rudiments of inner peristome present as a narrow membrane not reaching the height of the mouth of the capsule; spores in spring, but the author has never seen sporophytes on N. American plants. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 468;* M. H. M. *f. 212;* Limpricht, Laubm. **2**: 685. *f. 330; Pl. 66.*

EXSICCATI:—Grout, N. Am. Musc. Pl. 81.

On rocks and trunks of trees in cool woods, Southeastern Canada, northern New England, Ontario, Pennsylvania, west to Michigan and Iowa.

Both Cardot and Dixon have pronounced our American plant to be *sciuroides*, though Dixon considered the specimens sent to him as worthy of varietal rank. However, our material differs so greatly that it would be difficult to describe it as a variety.

As a rule the median cells of the upper ⅓ of the leaf are consistently longer than those of *L. brachypus*, but this is not always the case and occasional specimens are impossible to place with certainty.

3. LEUCODON JULACEUS (Hedw.) Sull. Musc. Allegh. 87. 1846 & Icones Musc. 110. *pl. 69.* 1864.

Pterigynandrum julaceum Hedw. Stirp. Crypt. **4**: 51. *pl. 69.* 1793 and Sp. Musc. 81. 1801.

Strongly resembling *L. brachypus* but with shorter secondary stems which *are terete-foliate, julaceous when dry*, often stoloniferous at the tips; leaves crowded, closely appressed-imbricate when dry, not at all secund, scarcely plicate, ovate-elliptical, rather abruptly short-acuminate, ± 1.5 mm. long, very concave with reflexed margins except at apex where they are often incurved, serrulate, *mammillose roughened at the back of the apex;* upper median leaf cells with a rather wider lumen than the other two species. *Capsule exserted, the perichaetial leaves scarcely reaching its base;* capsule and peristome about as in *L. brachypus;* spores late fall to winter. Type locality N. Am. (Pennsylvania). The Dillenian specimens were from Pennsylvania and Virginia.

ILLUSTRATIONS:—Sull. l. c.; M. H. M. l. c.; Jennings, Mosses W. Pa. *pl. 32.*

EXSICCATI:—Sull. Musc. Allegh. 87; Drumm. Musc. Am. S. States 91 (as *Pterogonium*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 231, (Ed. 2) 350; Aust. Musc. Appal. 258, 259; Grout, N. Am. Musc. Pl. 34; R. & C. Musc. Am. Sept. 80 & 80b.

On trees in woods, often mixed with other mosses. Southern New England, southern Ontario, west to Minnesota, south to the Gulf, mostly east of the Mississippi; Oklahoma, Texas, more abundant in the Southern States and fruiting freely.

While the dry leaves are slightly wrinkled, when moist they are free from plications; this and the shorter ovate leaves, nearly always somewhat roughened at the back of the apex, make this species easy to distinguish even when sterile.

Forma FLAGELLIFERUS Grout, Bryol. **26**: 30. 1923.

Plants producing numerous long slender flagella bearing small lanceolate leaves which are longly and slenderly acuminate, leaf cells more elongated and with thinner walls. Winston-Salem, North Carolina, P. O. Schallert. Type in herb. A. J. G.* This is not the stoloniferous form mentioned in Bryol. **21**: 32.

The slender flagella several mm. long are very different in appearance from those of *L. sciuroides*. The lower leaves approach normal, growing progressively narrower toward the ends of the flagella.

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* See *Habrodon*.

2. LEUCODONTOPSIS R. & C. Bull. Soc. Roy. Bot. Belg. **32**: (1). 177. 1893.
(*Leucodoniopsis* by typographical error.)

A small genus of 4 tropical or subtropical species whose position is uncertain, as none have ever been found with sporophytes. We have one species, the type species.

LEUCODONTOPSIS FLORIDANA (Aust.) E. G. B. Bryol. **15**: 28. 1912.

Neckera (*Pilotrichum?*) *floridana* Aust. Bot. Gaz. **4**: 152. 1879.
Leucodoniopsis plicata R. & C. l. c.
Pilotrichella floridana R. & C. Rev. Bryol. **20**: 11. 1893.

Plants in loose tufts, light green; primary stems creeping, with small ecostate slenderly acuminate leaves; secondary stems erect or pendent, short, 1–2 cm. long, reminding one of small forms of *Pireella cymbifolia* (except that the leaves are evenly distributed, not in rows), simple or sparingly branched; leaves loosely imbricate and somewhat irregularly wrinkled when dry, erect-open when moist, oblong-lanceolate, very slightly decurrent, ± 1.5 mm. long, concave with margins revolute almost to the apex, slightly serrulate at apex; costa simple, slender, extending about to the leaf middle; median leaf cells linear-flexuose, about 6 μ wide, 6–12 : 1, papillose on both faces with one or two low papillae over the lumen; at basal angles a large group of rounded-quadrate to transversely elongated minute cells reaching nearly half-way to the costa; other basal cells short, thick-walled and colored; reproducing by septate brood bodies borne in the axils of the leaves. Type locality Caloosa, Florida. Collected also at Grassy Key (Small) and cypress swamp near Sarasota-Arcadia road (Grout), also in the West Indies and Costa Rica.

ILLUSTRATIONS:—Bryol. l. c. *pl. 27; Pl. 64.*

3. PSEUDOCRYPHAEA E. G. B. Bull. Torr. Bot. Club. **32**: 261. 1905.*

A monotypic genus.

PSEUDOCRYPHAEA FLAGELLIFERA (Brid.) E. G. B. l. c.

Pilotrichum flagelliferum Brid. Bryol. Univ. **2**: 259. 1827.
Leucodon domingiensis Mitt. Journ. Linn. Soc. **12**: 409. 1869.

Plants in rather loose tufts; secondary stems simple below, freely branched above, somewhat dendroid in appearance, with branches reaching 5 cm. or more in length, often with numerous slender flagelliform branchlets; median leaves appressed-imbricate when dry, ovate to ovate-lanceolate, concave, slightly decurrent, broadly short-acuminate, ± 1.5 mm. long, sometimes obscurely papillose at back above; margins plane, serrulate above; costa slender, nearly or quite percurrent; median leaf cells in Florida plants, longer and narrower than figured, linear-rhomboidal, about 9 μ wide, 5–8 : 1, shorter towards the apex; basal thicker-walled, colored and porose; at basal angles a triangular patch of small quadrate to oblong cells with rounded lumen, reaching nearly to the costa. Capsule ovoid, exserted on a long slender yellow seta, brownish, erect; peristome unknown. Type locality, West Indies.

ILLUSTRATIONS:—Engler & Prantl, Musci (Ed. 2) **2**: *f. 502; Pl. 65.*
Collected at 5 stations in Florida; also in Central and South America.

4. PTEROGONIUM [Sw.] Bry. Eur. fasc. 46–47. *pl. 461.* 1851.

Pterogonium Sw. Disp. Syst. Musc. Frond. Suec. 26. 1799.

A monotypic genus of Europe and the west coast of North America.

PTEROGONIUM GRACILE (L., Hedw.) Bry. Eur. l. c.; also Sw. l. c.

Pterigynandrum gracile Hedw. Sp. Musc. 80. 1801.
Grimmia ornithopodioides Web. & Mohr, Bot. Taschenb. 148. 1807.

Plants olive green to brownish, in wide rather loose patches; secondary stems slender, usually unbranched below, 2–5 cm. high, with numerous clustered branches above, often giving the plants a dendroid appearance; branches curved to one side, slender, julaceous when dry with closely imbricated leaves, obtuse

* See citation for complete synonymy.

or elongated and flagelliform; leaves of upper stem and branches ovate, acute to acuminate, decurrent, about 1.5 mm. long, 2 : 1, sharply or even doubly serrate above, concave, excavate at base, papillose above at back by projecting cell angles; costa faint and short or lacking; leaf cells *thick-walled*, irregularly rhomboidal to oblong at apex, ± 9 μ wide, 3–4 : 1; median basal elongated, 4–8 : 1; a large area of basal-marginal cells, rounded-quadrate, gradually elongating and merging into the median; leaves of the shorter branches smaller with shorter rounded leaf-cells. Dioicous; seta 10–15 mm. long; capsule erect and symmetric or nearly so, oblong-cylindric, urn 2.5–3 mm. long; operculum conic; annulus large; calyptra cucullate, bearing a few hairs; peristome double, teeth cross-striate with papillae, papillose above; segments short and slender from a narrow basal membrane; spores in autumn. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 467;* Limpricht, Laubm. **2:** 782. *f. 345; Pl. 70.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 349; R. & C. Musc. Am. Sept. 316 (as var. *californicum*).

On rocks and bark of trees; California to Oregon east to Ontario. Common in California.

4. LEPTODON Mohr. Obs. Bot. 27. 1803.

Forsstroemia Lindb. Öfv. K. Vet.-Ak. Förh. **19:** 605. 1863.

Secondary stems numerous, usually erect, densely foliate, sparingly to pinnately branched; leaves appressed-imbricate when dry, erect-open when moist, ovate to oblong, short-acuminate; costa lacking, short and double or single and well developed; median leaf cells smooth, elliptical to oblong-rhomboidal, the marginal short and rounded. Autoicous in all our species; capsule immersed, exserted or emergent, ovoid to oblong, without stomata; peristome teeth linear-lanceolate, well developed; inner peristome rudimentary or lacking; annulus very narrow or lacking; calyptra cucullate, more or less hairy. Type species *L. trichomitrion.*

KEY.

1. Median leaf cells (except close to costa) not more than 2 : 1; costa single and strong, reaching the middle of the leaf or beyond; seta longer than the perichaetial leaves	*2. ohioensis.*
Median leaf cells more than 2 : 1; costa various, or lacking; seta shorter to longer than the perichaetial leaves	2.
2. Basal marginal cells quadrate to transversely elongated	3.
Basal marginal cells (except 3–4 at insertion) much longer than broad	*3. nitidus.*
3. Perichaetial leaves longer than the seta; capsule exserted	*1. trichomitrion.*
Perichaetial leaves shorter than the seta	*1a.* var. *floridanus.*
Perichaetial leaves reaching nearly or quite to mouth of capsule	*1b.* var. *immersus.*

In the simple peristome and leaf structure this genus seems closer to the *Leucodontaceae* than to the *Cryphaeaceae.*

Lindberg, l. c. proposed *Forsstroemia* (type *F. trichomitria*) to take the place of *Lasia* P. B. Prodr. 25 & 72. 1805, as that was preoccupied, overlooking the fact that Mohr had, in 1803, established *Leptodon*, based on *Pterigynandrumt richomitrion* Hedw. & *P. subcapillatum* Hedw. [*Homalotheciella subcapillata* (Hedw.) Cardot] and 9 other species.

Lindberg, Journ. Linn. Soc. **13:** 71. 1872, admits this but refuses *L. Smithii* Mohr a place in the genus. It seems to the author that from point of intention as indicated by Mohr's publication, *L. trichomitrion* has a better claim to be the type of *Leptodon* than has *L. Smithii*, which Mohr certainly did not consider the type of his genus *Leptodon.*

1. LEPTODON TRICHOMITRION (Hedw.) Mohr. l. c.

Forsstroemia trichomitria (Hedw.) Lindb. l. c.

Pterigynandrum trichomitrion Hedw. Sp. Musc. 82. *pl. 16.* 1801.

Plants dark- to yellowish-green, growing in rather wide loose tufts; secondary stems freely and subpinnately branched, densely foliate; sometimes with flagellate branchlets, leaves of secondary stems somewhat plicate when dry, concave with reflexed borders, ovate to ovate-lanceolate, 1.5–2 mm. long, rather abruptly short-acuminate to merely acute, entire or nearly so, slightly decurrent; *costa rather thin and reaching the leaf middle, short and double or almost wanting, sometimes all these variations on the same plant;* median leaf cells oblong-fusiform ± 8 x 30 μ, median basal 45–50 μ long, upper marginal and apical oval, oblong

or rhomboidal, 2–3 : 1, a large area of the basal-marginal cells very small and rounded-quadrate; branch leaves smaller, often serrulate at apex; perichaetial leaves slenderly acuminate, sheathing, as long as the seta or usually a little longer; capsule ovoid-cylindric to oblong-ovoid, urn about 1.5 mm. long; operculum rostrate, not quite ½ the length of the capsule; peristome teeth lance-linear, very slender at the tips, sometimes perforate along the median line; inner peristome a membrane usually more or less torn and adhering to the teeth; calpytra cucullate, reaching well below the capsule middle, bearing a few long hairs; spores late autumn to winter. Type locality, eastern North America.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 71;* M. H. M. *pl. 86.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 233, (Ed. 2) 352; Aust. Musc. Appal. 254; Grout, N. Am. Musc. Pl. 123, 321; Sull. Musc. Allegh. 88; Drumm. Musc. Am. 78, S. States 92.
On trees and rocks in cool woods, New England to Ontario and south to the Gulf States. Frequent and fruiting freely.
In xerophytic forms growing on rocks the leaves are sometimes broadly ovate with smaller cells, especially along the upper margin.
In view of the wide variations the following forms can scarcely be considered of more than varietal rank. The description in M. H. M. and indeed other available descriptions are more or less misleading and the fact that Musc. Bor. Am. (Ed. 1) 235, issued as *Leptodon ohioensis* is badly mixed with this species has increased the confusion.

Var. IMMERSUS (Sull.) Lesq. & James Manual, 278. 1884.

Leptodon immersus Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 234. 1856.

Capsules immersed; perichaetial leaves reaching at least to the mouth of the urn, much less slenderly acuminate as a rule.

EXSICCATI:—Sull. & Lesq. l. c.; Austin, Musc. Appal. Suppl. 527; Grout, N. Am. Musc. Pl. 226.
Frequent in Georgia and Florida and probably in all the Gulf States.

Var. FLORIDANUS (Lindb.) **n. comb.**

Leptodon floridanus Lindb. Krit. Gransk. Moss. Dill. 53. 1883.

Plants mostly smaller; seta longer than the perichaetial leaves.

Occasional in peninsular Florida.
A series could be arranged with the capsules entirely immersed in the first specimen and gradually emergent to the fully exserted form. Without the sporophytes I do not think one could distinguish the species from the varieties. The description of the leaves in the Lesq. & James Manual states that the leaves in *L. floridanus* are "broader and ovate." On the contrary I find the leaves of specimens with the fully exserted capsules narrower than the average. I also find the narrowly ovate-lanceolate and broadly ovate leaves in the northern forms.
Also the capsules in the var. *floridanus* are not smaller than is frequent in the species and porose basal cells are also frequent in the older leaves of the species.
The var. *irriguus* Renauld, Lesq. & James Manual, 278, 1884 is apparently only a form from a wet habitat, though type specimens have not been seen.

2. LEPTODON OHIOENSIS Sull. Musc. Allegh. 89. 1846.

Smaller, more slender and darker colored than the last, little branched; leaves closely appressed-imbricate when dry, not plicate, ovate to ovate-lanceolate, acute to short-acuminate, concave with margins slightly reflexed, ± 1.2 mm. long, slightly decurrent, entire or margins slightly uneven near apex; *costa strong, extending beyond the leaf middle and strongly protruding on the dorsal side of leaf;* leaf cells often slightly papillose dorsally, rounded-oval in the median portion of leaf, thick-walled, about 6 μ wide, 1.5–2.5 : 1, slightly elongated ati nsertion; marginal cells rounded-quadrate below, short oval above. Capsule and peristome much as in the last, but the perichaetial leaves somewhat shorter than the seta. Type locality, Ohio (Sullivant).

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 72; Pl. 68.*
EXSICCATI:—Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 235, (Ed. 2) 354.
On trees in deep woods, central Ohio. Apparently rare and reported from the vicinity of the type locality only. Sull. & Lesq. no. 235, in my set at least, is badly mixed with the last, also (Ed. 2) 354. This has apparently led to much confusion. Except that they are somewhat larger, the leaves of this species are surprisingly like those of *Cryphaea glomerata.*

LEPTODON NITIDUS Sull. Icones Musc. Suppl. 80. *pl. 60.* 1874.

Plants yellowish green, glossy; secondary stems erect or curved, 3–6 cm. long, irregularly branched, with branches short, slender and densely foliate; leaves erect-imbricate, broadly oblong-ovate, acute to short-acuminate, concave, ± 1.2 mm. long, decurrent and subauriculate at base, entire or subserrulate near apex; costa simple, vanishing before the leaf middle, or double or forking and much fainter, sometimes lacking; leaf cells smooth, the median elongated-rhomboidal to oblong-linear, ± 8 μ wide, 3–6 : 1; apical short-rhomboidal,* 2 : 1; a few (2–8 marginal) short-rectangular at the subauriculate basal angles; perichaetial leaves broadly ovate or lingulate, acute, ecostate, the upper reaching beyond the mouth of the urn. Monoicous; capsule immersed on a very short seta, ovoid-globose, urn with a dark colored mouth; operculum broadly conical, apiculate; peristome simple, teeth linear-lanceolate, very brittle.

Type locality on elms in a swamp (now cleared) near Belleville, Ontario (Macoun). The only known locality.

ILLUSTRATIONS:—Sull. l. c.; *Pl. 68.*

CRYPHAEACEAE.

Main stems creeping, stoloniform; secondary stems erect or ascending, often with axillary paraphyllia, variously branched; leaves close, symmetrically arranged on all sides of the secondary stems and branches, imbricate when dry, more or less spreading when moist, concave, mostly not plicate, ovate to ovate-lanceolate, often papillose dorsally; costa single, usually well developed; leaf cells mostly thick-walled with an oval or narrowly elliptical lumen; at the basal margins many subquadrate rounded cells; median basal usually more elongated. Autoicous; seta usually very short and capsule often immersed; capsule erect and symmetric; peristome double, the teeth 16, well developed; segments narrowly linear to lanceolate from a very low basal membrane, rarely lacking; calyptra conical or bell-shaped, small, more or less roughened to hairy, in our species.

In many cases scarcely to be distinguished from the *Leucodontaceae* except for the double peristome. The leaves of *Leptodon ohioensis* are scarcely to be distinguished from some forms of *Cryphaea glomerata* and it is probable that that species should be put in a different genus and transferred to this family. Our species are mostly found on trees, rarely on rocks.

KEY.

1.	Capsule immersed; calyptra conical; paraphyllia lacking	1. *Cryphaea.*
	Capsule emergent or exserted; calyptra cucullate	2.
2.	Paraphyllia lacking; seta much longer than perichaetial leaves	2. *Antitrichia.*
	Paraphyllia present; seta about the length of perichaetial leaves or a little longer	3.
3.	Leaves smooth at back	4. *Alsia.*
	Leaves sharply papillose on the back above	3. *Dendroalsia.*

1. CRYPHAEA Mohr, in Web. Tab. Synop. Musc. 1813.

Leaves mostly broadly ovate, acute to short-acuminate, entire or slightly serrulate above; leaf cells small, rounded, very thick walled, isodiametric to 2 : 1, papillose at back; costa strong, reaching at least to the leaf middle, projecting at back; upper perichaetial leaves more or less obtuse, tipped by the strong excurrent, more or less roughened costa (except *C. Ravenelii*); the lower more gradually long acuminate with the costa excurrent; capsules mostly ovoid; peristome double, teeth usually papillose; segments narrowly linear; cilia lacking. Type species, *C. heteromalla* Mohr.

KEY.

1.	Leaves rounded-obtuse; peristome single	3. *Ravenelii.*
	Leaves acute to acuminate; peristome double	2.
2.	Costa ending in or near leaf apex	2. *nervosa.*
	Costa ending near leaf middle	1. *glomerata.*

* Much shorter than figured by Sullivant. Type studied by courtesy of New York Botanical Garden.

1. CRYPHAEA GLOMERATA Schimp., Sull. in Musci & Hepat. U. S. 56. 1856 and Bry. Eur. Fasc. 44–45. 1850. (name only).

Cryphaea filiformis Sull. Musc. Allegh. 81. 1846 (not of Hedw.).
Cryphaea pendula Lesq. and James. Proc. Am. Acad. Sci. **14**: 138. 1879.

Plants in thin loose mats, light green above, brownish below; secondary stems sparingly divided, little branched, slender, sometimes with slender branchlets having narrow slenderly acuminate leaves; leaves closely imbricated when dry, julaceous, ovate to ovate-elliptical, acute to short-acuminate, concave, ± 1 mm. long; margins slightly recurved below, entire or slightly serrulate at apex; costa strong, reaching at least the leaf middle, projecting on the dorsal side; leaf cells as described for the genus, only those in the median basal ⅓ as long as figured, the median subcircular to oval, ± 7 wide, the lumen 4–5 μ wide; perichaetial leaves scarious, as long as the capsule or longer, the outer gradually long-acuminate by the strong excurrent costa, the inner broadly obtuse with the costa excurrent into a longer or shorter point, more or less roughened, leaf cells linear-rhomboidal in the lower half, without chlorophyll. Seta exceedingly short, scarcely apparent; calyptra conical, little longer than the operculum, smooth or rough, entire or split when old, deciduous with the operculum; capsule short-oblong to ovoid, urn ± 1 mm. long, operculum conic; annulus large; peristome teeth slender, papillose; segments much shorter, very narrowly linear and hard to demonstrate; spores in spring. Type locality, New Orleans.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 67; Pl. 67.*
EXSICCATI:—Drumm. Musc. Am. S. States, 99 (as *Daltonia heteromalla* var.); Sull. Musc. Allegh. 81; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 230, (Ed. 2) 347; Aust. Musc. Appal. 253 and Suppl. 526 (as *C. pendula* Lesq. ined.); Grout, N. Am. Musc. Pl. 32, and Musci Perfecti 218 in part.
Austin's 526 is apparently one of the type forms of *C. pendula* and neither in this or the descriptions can I find any characters to separate *C. pendula*, except "perichaetial leaves with a short acumen, the solid costa vanishing at or below the apex." This is not true of Austin's plants and the variations of this species are greater than indicated in any previous literature.
On trees and shrubs, Gulf States, north to Connecticut; west to Texas; frequent and fruiting freely, but usually occurring in small quantities. Rare west of the Mississippi.

Var. SCABRA **n. var.**

Leaves less closely imbricate, 1.2–1.5 mm. long, subclasping, strongly excavate and almost auriculate at base; perichaetial leaves not scariose, the upper less obtusely narrowed to the long (0.5–0.7 mm. long) very rough excurrent costa which is rough some distance below leaf apex. Capsules often at the end of stem or branch and relatively inconspicuous. Type from branches of shrubs, Deep Lake, Florida Everglades, March 41, 1931, Grout & McFarlin no. X°. *Pl. 63.*

If it were not for the variations in the direction of the above noted characters in the considerable range of specimens studied, this would be considered a new species. Its field appearance is very different from the species. Grout, Musci Perfecti 218 in part; this is co-type and easily distinguished with a lens by the perichaetial leaves the same color as the others and with hair-like points.

2. CRYPHAEA NERVOSA (Hook. & Wils.) Bry. Eur. l. c.

Daltonia nervosa Hook. & Wils. in Drumm. Musc. Am. S. States 100. 1841.

Closely resembling the last, differing in the less crowded leaves, narrower, ovate-lanceolate to lanceolate, longer acuminate, ± 1 mm. long; median cells along the costa linear below, oblong above; costa ascending to near or into the apex; papillose-roughened at back; perichaetial leaves very rough above with large papillae, gradually slenderly acuminate, the inner finely serrulate above. Capsule shorter and relatively broader, with a ring of dark colored cells around the mouth; annulus of a single row of cells. Type locality near New Orleans.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 68; Pl. 67.*
EXSICCATI:—Drumm. l. c.
Described from Drummond's 100 by courtesy of the New York Botanical Garden.
On trees and shrubs, rare; Gulf States; S. Carolina.

3. CRYPHAEA RAVENELII Aust. Bot. Gaz. **2**: 89. 1877.

Forsstroemia Ravenelii Kindb. Bryin. Eur. & N. Am. 7. 1897.

Plants dirty green; secondary stems short, 2–3 cm. long, julaceous, nearly simple; leaves imbricate-appressed when dry, oblong-ovate to ovate, *rounded-obtuse at apex*, ± 1.2 mm. long, very concave, *spoon-*

shaped, with entire margins slightly reflexed below; costa stout, extending ¾ the length of the leaf; *leaf cells very dense and thick-walled*, papillose at back, ± 6 μ wide, *nearly uniform throughout except at median leaf base*, circular to short-oval, transversely elongated at basal angles; median basal linear to oblong, often colored at insertion; perichaetial leaves thin and pale, the inner abruptly short-acuminate by the excurrent costa which may be thin and vanishing in places or extending through the whole leaf. Capsule immersed, urn about 1.2 mm. long, with a *bright red border around the mouth*, ovoid to oblong-ovoid; operculum conic; *peristome single, apparently of 8 perforate teeth but in reality of 16 slender teeth more or less united in pairs*, about 0.7 mm. long, with very few articulations, irregularly roughened and lighter colored than the mouth of the capsule.

Described from the type collection at Rome, Georgia, by Ravenel, 1874, courtesy of the New York Botanical Garden. *Pl. 63*.

A beautiful and distinct species, noteworthy for its single peristome. Apparently very rare. No other collections found.

2. ANTITRICHIA Brid. Musc. Recent. Suppl. 4: 136. 1819.

Secondary stems usually long, procumbent or pendent, simple or divided, densely foliate, irregularly to subpinnately branched; paraphyllia lacking; central stand rudimentary or lacking; leaves appressed-imbricate when dry, occasionally somewhat secund, cordate-ovate to ovate-lanceolate, rather abruptly acuminate, lower margins revolute; costa strong, ending below the apex, sometimes with one or two short, supplementary costae at base; leaf cells thick-walled and porose, in the basal angles rounded-quadrate to elliptical cells reach nearly to the costa and well up the margin; median cells with a linear lumen. Dioicous; capsule exserted on a seta 5–12 mm. long; oblong-ovoid to cylindric, erect and symmetric; calyptra smooth, naked, cucullate; annulus present; peristome double, without cilia, and segments poorly developed. Type species, *A. curtipendula*.

Key.

Leaves with supplementary costae; capsule 2–2.5 : 1 ..... *1. curtipendula.*
Leaves without supplementary costae; capsule 3–5 : 1 ..... *2. californica.*

1. Antitrichia curtipendula (Hedw.) Brid. l. c.

Neckera curtipendula Hedw. Sp. Musc. 209. 1801.

Plants large, in large loosely tangled mats, yellowish green in the tips, brown below; secondary stems 10–20 cm. long, densely foliate; leaves loosely imbricated, often subsecund, decurrent, ovate to broadly ovate-lanceolate, rather gradually long-acuminate, 2–3 mm. long, concave and usually somewhat plicate when dry; *margins strongly revolute below, sharply dentate-serrate above with long, often reflexed teeth* especially at apex; costa strong, often divided at base, vanishing below apex; median leaf cells oblong-linear, about 6 μ wide, 3–5 : 1, basal angular cells as described above; perichaetial leaves sheathing, the inner abruptly filiform-acuminate, nearly ecostate. Seta 5–15 mm. long, more or less flexuous; capsule symmetric, oblong-ovoid, ± 3 mm. long; operculum conic-rostrate, ⅓–½ the length of the urn; inner peristome without basal membrane, segments nearly as long as teeth, filiform, fragile; spores in spring. Type locality Giessen (Dillenius).

Illustrations:—Bry. Eur. *pl. 469;* Dixon & Jameson, Handb. British Mosses (Ed. 3) *pl. 50A; Pl. 70.*
Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 236, (Ed. 2) 355; R. & C. Musc. Am. Sept. 315.

On shaded trees and rocks; mountains of North Carolina, Lake Superior region and the West Coast of N. America from Alaska to California. The West Coast plants are mainly the variety.

Even in Europe the species varies widely, some forms stout with stems and the few branches stout, julaceous and blunt; others more slender and freely branched, with branches slender and tapering and the leaves somewhat secund.

Var. gigantea Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 356.

Plants larger; branching sometimes regularly but distantly pinnate, much as in *Rhytidiadelphus triquetrus*, branches sometimes very slender at end; leaves often loosely imbricate and strongly secund; leaves of secondary stems often slightly serrate or nearly entire at apex; costa with 3–5 branches; branch leaves dentate-serrate as in the species; capsule longer and narrower as a rule. Any of these characters is variable, some may be like the species while the others are those of the variety.

Exsiccati:—Grout, N. Am. Musc. Pl. 67, 228.

2. *ANTITRICHIA CALIFORNICA Sull. Trans. Am. Phil. Soc. **13**: 11. 1863.

* *Antitrichia tenella* Kindb. Bull. Torr. Bot. Club, **17**: 275. 1890.
Antitrichia curtipendula Sull. Pacif. R. Rep. **4**: 189. 1856.

Secondary stems shorter, 5–10 cm. long, appearing more slender than the last by reason of the nearly or quite julaceous slender branches and the non-secund leaves;† branching often almost regularly pinnate with short, subequal branches, 5–15 mm. long; stem leaves as a rule much less strongly toothed above, but branch leaves as in the last; costa very wide and stout at base but seldom branched, usually reaching farther up into the apex; median leaf cells shorter, about 15 μ long with very thick walls and a linear-flexuose lumen in old leaves, in younger leaves with a thinner wall and an oval lumen as shown in Sullivant's plate. Capsules cylindric to oblong-cylindric, urn reaching 3.5 mm. long and narrower; annulus apparently lacking; peristome teeth strongly papillose throughout, segments very short and fragile as figured, sometimes partially adherent to the teeth; spores rough, 15–20 μ, ripening in early spring. Type from California.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl. 59; Pl. 64.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 357; Grout, N. Am. Musc. Pl. 166; Allen, Mosses Cascade Mts. 87; Baker, Pacific Coast Bryophytes 293.
On rocks soil and trees; Los Angeles Co., California, to British Columbia, east to Colorado.
The capsules of this species are narrower rather than very much longer than those of the preceding. The stem leaves of var. *gigantea* are often as slightly serrulate as those of *A. californica* but in sterile specimens the habit and short leaf cells of *A. californica* are in most cases sufficient for identification. But in some cases the leaf cells approach those of *A. curtipendula* and depauperate or undeveloped plants are often difficult to place.

3. DENDROALSIA E. G. B. Bull. Torr. Bot. Club, **32**: 263. May, 1905.

Groutia Broth. Engler & Prantl, Musci (Ed. 1) 760. Aug. 1905.

A monotypic genus. The differences between *Leptodon circinnatus* Sull. and *Neckera abietina* Hook. as set forth by Mrs. Britton, Bull. Torr. Bot. Club **32**: 264 and 265 are not correlated. The differences occur in *Dendroalsia* but seem to be wholly unrelated. Tall plants 5 inches high, with slender naked stipes 2–3 inches long are sometimes males, with leaves not papillose to base, while short plants about 2 inches high with very short stipes fruit freely and have leaves often papillose to base. In general the undeveloped upper leaves are relatively broader and more papillose near base. The plants are not rare, as there are plants of 15 different collections in my private herbarium. The differences seem to be due to habitat conditions, as Sullivant surmised.

DENDROALSIA ABIETINA (Hook.) E. G. B. l. c.

Neckera abietina Hook. Musc. Exot. *pl. 7.* 1818.
Alsia abietina Sull. Icones Musc. 115. *pl. 72b.* 1864.
Leptodon circinnatus Sull. Pac. R. Rep. **4**: 189. *pl. 1.* 1856 (sometimes *circinalis* by error).
Alsia Macounii Kindb. Bull. Torr. Bot. Club **17**: 275. 1890.

Secondary stems frondiform, pinnately to bipinnately branched above, with a longer or shorter unbranched stiff and elastic stipe-like portion below, reaching 25 cm. in length,‡ but usually 10 cm. or less, more or less circinate when dry; branched paraphyllia numerous; branches 1–2 cm. long, sometimes ending in slender flagellate tips, leaves of stipe broadly lanceolate to ovate-lanceolate, 2.5–3.5 mm. long, somewhat plicate, especially when dry, colored at the base, gradually acuminate, with acumen short and broad to long and slender; median cells oblong linear, thick-walled, 7 μ wide, 3–5 : 1, longer and porose at base; costa very strong and deeply colored, ending a short distance below the apex; leaves of the upper stem smaller and narrower, 2–2.5 mm. long, gradually narrowed to an obtuse serrulate apex; leaf cells less incrassate; all stem leaves with margins revolute below, more or less concave, papillose at back with large sharp papillae, which are often few or lacking in the leaves of the stipe; angular and lower marginal cells nearly isodiametric, rounded-quadrate to irregular in outline, 10–12 μ wide; leaves of branches and branchlets smaller, more strongly papillose and often acute; inner perichaetial leaves usually a very little longer than the seta, abruptly short-acuminate, with the costa slender below and either excurrent into the

* "Seems to be the young shoots before they branch." Mrs. Britton in notes at N. Y. Bot. Garden.
† Slightly secund in var. *ambigua* R. & C. Bot. Gaz. **15**: 59. 1890.
‡ Mrs. Britton l. c.

short acumen or ending below the apex. Dioicous; antheridial buds very numerous along the stem and branches; archegonia borne along the stem; seta 0.6–0.8 mm. long; capsule oblong-ovoid to ovoid, urn about 2.5 mm. long, strongly plicate when dry; operculum conic-rostrate; annulus present; peristome teeth almost linear, 0.6 mm. or more in length, strongly papillose; segments somewhat shorter, from a narrow basal membrane, narrow, somewhat carinate and often open between the articulations, strongly papillose; calyptra cucullate, naked, longer than the operculum; spores in spring, very rough, 18–25 μ in diameter. Type locality, northwest coast of North America (Menzies 1792). Type in the herbarium of Hooker.

Illustrations:—Sull. l. c.; Hook. l. c.; *Pl. 69.*
Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 400; Grout, N. Am. Musc. Pl. 379; Allen, Mosses Cascade Mts. 83; Baker, Pac. Coast Bryophytes 118.
On trees and ledges; California to British Columbia, east to Idaho. Dr. Bailey has sent me specimens from California used to pack vegetables sent to Washington.

4. ALSIA Sull. Proc. Am. Acad. **3**: 185. 1855.

Plants in thick loose mats; secondary stems erect or ascending, densely foliate, with branching more or less regularly pinnate above and frondiform; branched paraphyllia present; costa various even on the same plant; leaf cells much like those of *Leptodan;* upper median short, oval-oblong, about 3 : 1; a large area of marginal cells, especially at the basal angles, small, rounded, not longer than broad, some broader than long. Dioicous; capsules short, nearly or quite erect and symmetric, on a short seta, which is usually shorter than the perichaetial leaves; stomata present; annulus not differentiated; peristome double, segments from a narrow basal membrane, cilia lacking; operculum conic-rostrate; calyptra cucullate, naked. Type species *A. californica.*

Alsia californica (Hook. & Arn.) Sull. l. c.

Neckera Californica Hook. & Arn. Bot. Beechey's Voy. 162. 1841. (1833 according to Mrs. Britton, Bull. Torr. Bot. Club. **32**: 263. 1905.)
Antitrichia pseudo-californica Kindb. Eur. & N. Am. Bryin. 9. 1897.

Secondary stems 2.5–5 cm. high, with branching more or less regularly pinnate, branches short, of unequal length, 3–6 mm. long; stem leaves loosely imbricate when dry, scarcely plicate; ovate to broadly oblong-lanceolate, gradually acute to acuminate, varying in length from 1.2 to nearly 2 mm. in length, entire to slightly serrulate at apex, smooth, concave, with margins more or less reflexed below; costa almost lacking, short and double, or stout, reaching nearly to leaf middle (all forms occurring on the same plant); median cells near leaf base $\pm$ 10 μ wide x 30–60 μ, oblong-linear, somewhat porose, thick-walled, those at insertion shorter and often colored; the median cells of the upper $\frac{1}{3}$ oval-rhombic, $\pm$ 10 μ wide, 2–3 : 1: marginal cells in the lower $\frac{2}{3}$ rounded-quadrate, gradually changing in shape towards the leaf middle, all marginal and apical cells shorter than the median; branch leaves smaller, usually relatively narrower and often ecostate; slender flagella with small ecostate leaves often present (var. *flagellifera* R. & C.); inner perichaetial leaves $\pm$ the length of the seta, lanceolate, costate, long and slenderly acuminate. Capsules oblong-cylindric, urn reaching 2 mm. in length, often slightly unsymmetric; segments of inner peristome much shorter than the teeth, unusually persistent; spores apparently in spring. Type locality, west coast of North America.

Illustrations:—Sull. Musc. Wilkes Exped. *pl. 25;* Engler and Prantl (Ed. 2) 2: *f. 495; Pl. 57.*
Exsiccati:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 268b, (Ed. 2) 398; Grout, N. Am. Musc. Pl. 256 (this is var. *flagellifera* R. & C. Bot. Gaz. **14**: 97. 1889).
On tree trunks; California to Puget Sound.
This genus is very close to *Leptodon*, separated mainly by the double peristome with basal membrane and segments.

FABRONIACEAE.

As a whole the smallest and most delicate of the Pleurocarpi; mostly plants of warm regions, growing in thin velvety mats or tufts, often glossy, usually on trees, rarely on stones. Primary stems creeping, without central strand, composed largely of large thin-walled cells, producing many erect and simple or divided branches, which are densely foliate; paraphyllia lacking; leaves soft, thin, not papillose,* imbricate when dry, erect spreading when moist, slightly concave, never plicate, rarely decurrent or secund, mostly ovate to lanceolate, acuminate, entire to ciliate-dentate; costa extending $\frac{1}{2}$ length of leaf or lacking; leaf cells thin-

* Except *Schwetschkeopsis.*

walled, oblong-rhombic to narrowly oblong-hexagonal; alar often quadrate to short-rectangular. Capsules long-exserted, erect and symmetric, usually short, ovoid to nearly cylindric, often strongly contracted under the mouth when dry and empty; peristome single or double (rarely lacking), teeth 16, often united in pairs and reflexed as in *Orthotrichum;* segments, when present, narrowly linear, fragile; operculum short-conic to short-rostrate; calyptra cucullate, smooth and naked.

Key.

1.	Leaves plainly costate	2.
	Leaves ecostate or nearly so	4.
2.	Leaves slightly denticulate to long ciliate-dentate	1. *Fabronia.*
	Leaves entire (rarely minutely serrate at apex)	3.
3.	Peristome double, teeth well developed, united in pairs and reflexed when dry	2. *Anacamptodon.*
	Peristome single, teeth slender and irregular, not reflexed or united in pairs	3. *Clasmatodon.*
4.	Leaves serrulate throughout; leaf cells slightly papillose at back	6. *Schwetschkeopsis.*
	Leaves entire or slightly serrulate at apex	5.
5.	Peristome single	4. *Habrodon.*
	Peristome double; plants of western Canada	5. *Myrinia.*

1. FABRONIA Raddi, Atti dell. Acad. di Scienze di Siena 9: 230. 1808.

Plants exceedingly small and slender, in soft thin mats or patches; stems creeping, often stoloniferous, irregularly branched; branches often partly stoloniferous, the normal leafy parts julaceous; leaves often rather closely imbricate when dry, erect-spreading when moist, rarely somewhat secund, somewhat concave, not plicate, ovate to lanceolate, mostly slenderly subulate-acuminate or piliferous, nearly entire to serrate or even ciliate-laciniate, with plane margins; median cells elongate-rhomboidal to elongate-hexagonal; at basal angles or often across the entire leaf base many rows of quadrate cells (occasionally greatly reduced in number); costa delicate and short, sometimes scarcely visible; seta 3–7 mm. long, slender, smooth; capsules erect and symmetric, ovoid to pyriform, with a short neck, often plicate when dry, often cup-shaped to hemispheric; exothecial walls sinuous and often bulging; operculum apiculate or usually more or less rostrate; annulus lacking; peristome single, rarely lacking, very hygroscopic, at first united in pairs, broad, obtuse (much like those of *Orthotrichum*), infolded when wet, spreading to reflexed when dry; calyptra cucullate, small deciduous.

Key.

1.	Leaves laciniate-dentate, with teeth often of more than one cell	2.
	Leaves from nearly entire to dentate with large projecting marginal cells	3.
2.	Peristome present; frequent in the West	2. *pusilla.*
	Peristome lacking; very rare	3. *gymnostoma.*
3.	Leaves entire or nearly so	5. *Ravenelii.*
	Leaves from dentate to ciliate-dentate with single cells	4.
4.	Leaves ovate to broadly ovate-lanceolate	5.
	Leaves for the most part broadly ovate	7.
5.	Leaves lanceolate, moderately and rather evenly serrate	4. *Wrightii.*
	Leaves broader, ovate-lanceolate	4. var. *intermedia.*
	Leaves ovate-lanceolate, strongly and irregularly serrate-dentate by projecting cells	6.
6.	Median leaf cells about 9 μ wide, 3–5 : 1 in American plants (4–9 : 1 in European)	1. *ciliaris.*
	Median leaf cells 13 μ wide, 2.5–4 : 1	1. var. *Bartramii.*
7.	Leaves slightly serrate; peristome imperfect	6. *imperfecta.*
	Leaves strongly serrate-dentate; peristome normal for the genus	1. var. *ovata.*

1. FABRONIA CILIARIS (Brid.) Brid. Bryol. Univ. 2: 171. 1827.

Hypnum ciliare Brid. Musc. Recent. Suppl. 2: 155. 1812.
Fabronia octoblepharis (Schleich.) Schwaegr. Suppl. 1²: 338. *pl. 99. figs. a & b.* 1816.
Pterogonium octoblepharis Schleich. Catal. (Ed. 2) 30. 1807 (name only).
Fabronia pusilla Schwaegr. l. c. 337 (not of Raddi, 1808).

Plants small, in thinly cespitose mats or patches; branch leaves symmetrically erect-spreading when moist (rarely two-ranked or secund at ends of branches), ovate-lanceolate, coarsely and irregularly serrate-dentate by single marginal cells of *varying length*, very slenderly long-acuminate, the tip of the acumination consisting of a single linear cell reaching 40–60 μ in length, reaching 1 mm. in length in European specimens, but rarely over 0.6 mm. in American forms; costa ± ½ the length of leaf, rather thin and vanishing in elongated cells; leaf cells in American plants linear-rhombic to oblong-hexagonal, 8–10 μ wide, 3–5 : 1; a large area of basal cells quadrate to short-hexagonal. Monoicous; seta 4–7 mm. long; capsule ovoid to urn-shaped when empty, with a thick neck, about 1 mm. long, operculum mammillate; peristome as described for the genus; spores in spring, rough, 15–18 μ in diameter. Type locality European.

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. *pl. 451;* M. H. M. f. 211.
EXSICCATI:—Aust. Musc. Appal. Suppl. 535; Grout, N. Am. Musc. Pl. 451; R. & C. Musc. Am. Sept. 189.
On rocks and bark of trees, New Jersey to Minnesota, south to Arizona, New Mexico and the South Atlantic States.

Var. OVATA **n. comb.**

Fabronia octoblepharis var. *ovata* Grout, Bryol. **29**: 5. 1926.

Most leaves crowded, broadly ovate to almost circular and more abruptly acuminate, widely spreading when moist; median cells 10–12 μ wide, 2–3 : 1, quadrate alar cells sometimes extending nearly half way up the margin. Type from willows near Lewiston, Minn., July 5, 1919 (Holzinger). Mixed with occasional subtypical forms. Type in herb. A. J. G.

Var. BARTRAMII **n. comb.**

Fabronia Bartramii Grout, Bryol. **29**: 4. 1926.

Leaves shorter than *F. Wrightii* or its var. *intermedia*, 0.4–0.6 mm. long, ovate to ovate-lanceolate and rather abruptly acuminate or broadly ovate-lanceolate and less abruptly acuminate, nearly entire to as serrate as figured for *Wrightii;* median leaf cells, 15 μ wide, 3–4 : 1; costa thin and faint rarely reaching the leaf middle; seta 1.5–2.5 mm. long; capsule turbinate when dry and empty, cup-shaped to almost hemispheric when moist; urn with neck about 0.6 mm. long, nearly as wide when mounted on a slide; operculum mammillate; spores 17–20 μ in diameter, ripening in winter. Type from face of overhanging banks along Harshaw Creek near Patagonia Mts., Santa Cruz Co., Arizona, alt. 4500 ft. (Bartram no. 631, Feb. 14, 1923). Type in herb. A. J. G., also cotypes issued as no. 493, Grout, N. Am. Musci Pl.

On banks and in rock crevices; collected by Bartram in several localities in Arizona, nos. 583a, 633, 640, 720, 894, & 972. A single collection was made on trees.

This species varies so much, both in North America and Europe, that this, together with its minute size, make it very difficult to draw satisfactory descriptions. Cardot's Musc. Eur. 240 has leaves reaching 1 mm. in length and median leaf cells slightly removed from the end of the costa reaching 75 x 9 μ, while plants from Thériot have shorter leaves with corresponding cells 60 x 12 μ.

The Bry. Eur. figure reproduced in M. H. M., l. c., has median cells 5 : 1. Schwaegrichen's figure cited above has the short acumination of var. *Bartramii* and its short broad leaf cells. No two American specimens seem to match and there is great variation in the same tuft. North Am. Musci Pleurocarpi 451 is as close to some European plants as any other American plants I have seen.

Var. *ovata* is probably a sport due to local conditions. Hedwig in the same plate cited illustrated a form with teeth as long in the leaf serrations as in *F. pusilla* and both in Europe and America *ciliaris* and *pusilla* seem to intergrade. *Gymnostoma* seems to have been collected but once and its leaves cannot be distinguished from those of *pusilla*. This leads one to suspect that it is an undeveloped form of *pusilla*.

Cardot's var. *americana* from Mexico (Rev. Bryol. **37**: 50. 1910) is compared with the species (*octoblepharis* = *ciliaris*), smaller, more densely cespitose; leaves smaller, narrower, more gradually longer acuminate, with cells smaller. He states that most American specimens belong to this variety, but the acumination he describes is just opposite the tendency the author has noted in American plants. *F. ciliaris* seems to intergrade with *Wrightii* and the latter is best regarded as a subspecies.

*2. FABRONIA PUSILLA Raddi, Crit. Nov. et Rar. Plant. 2. *pl. 1* in Atti dell' Acad. di Scienze di Siena 9: 230. 1808.

Apparently a subspecies of *F. ciliaris* from which it differs in the ciliate-laciniate margins of the leaves which usually have a longer hair point, a shorter fainter costa and broader and shorter leaf cells (Limpricht says 12 μ wide and 3 : 1); capsule usually shorter, urn with neck about 6 μ long; spores winter to early spring, rough, 12–17 μ in diameter. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 450;* Raddi, l. c.
EXSICCATI:—Baker, Pacific Coast Bryophytes, 289; Grout, N. Am. Musc. Pl. 402 & 436; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 375.
On trees, rarely on rocks. British Columbia, Idaho, California, Arizona, New Mexico and Colorado.
Only a very small proportion of the marginal teeth of the leaves is multicellular; most are unicellular like the large teeth in *F. ciliaris.*

*3. FABRONIA GYMNOSTOMA Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 254, 1856. (Ed. 2) 378.

Much like the preceding and difficult to distinguish if sterile. The leaves average a little shorter and the margins less laciniate. The costa is stronger and reaches the middle of the leaf or beyond. There is no peristome, the mouth of the pyriform capsule being closed by a transverse membrane. Type from near Santa Fé, New Mexico (Wright). No other collection has been reported except (Ed. 2) 378. No. 254 has been carefully studied but the above are the only differences noted.

ILLUSTRATIONS:—Sull. Icones. Musc. *pl. 86; Pl. 72.*

*4. FABRONIA WRIGHTII Sull. Mosses U. S. 61. 1856, & Icones Musc. 133. *pl. 84.*

Close to *F. ciliaris* but differs in the lanceolate, less strongly serrate-dentate leaves, ± 1 mm. long, having the margins rather evenly and regularly serrate by projecting cells, which are often much longer proportionally than figured; median leaf cells ± 12 μ wide, 2–4 : 1, oblong-hexagonal; quadrate alar cells much less numerous. Seta 2–4 mm. long; capsule pyriform; operculum conic-apiculate; spores 11 μ in diameter. Type locality, Texas (Wright).
Specimens of what is the type collection, Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 251, have been studied. Some of the leaves are almost as strongly toothed as those of *F. ciliaris.*

ILLUSTRATIONS:—Sull. l. c.; *Pl. 72.*
EXSICCATI:—Sull. & Lesq. l. c. and (Ed. 2) 374.
Also in Arizona (Bartram).

Var. INTERMEDIA Grout, Bryol. **29**: 4. 1926.

Leaves ovate-lanceolate, sometimes broadly so; margins serrate as figured for the species; leaf cells averaging shorter. Type Bartram's 593, issued as N. Am. Musc. Pl. 494. On bark of oak, Red Mt., Patagonia Mts., Santa Cruz Co., Arizona. Type in herb. A. J. G.

Bartram has made several collections in Arizona, some on rocks, some on trees. (See original description for details.)
When the original description was drawn the author did not have access to Sull. & Lesq. Musc. Bor. Am. 251, hence a little discrepancy. The marginal serration in Sullivant's plate is quite misleading.

5. FABRONIA RAVENELII Sull. Mosses of the U. S. 61. *pl. 14.* 1856.

Fabronia caroliniana Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 253. 1856.

Closely resembles *F. Wrightii.* Leaves broader, often nearly or quite entire, ± 0.6 mm. long; quadrate alar cells more numerous as figured; spores ± 17 μ in diameter, maturing in spring.
Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 252 is the type collection; collected in South Carolina by Ravenel. On bark of trees and decaying logs; Pennsylvania to Tennessee and Georgia, probably in all the Gulf States; rare.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 85; Pl. 72.*
EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 376 and 377 as var.
The *Fabroniceae* are the pygmies of the pleurocarpous mosses. Their small size and the great variation in the leaves on a single plant make satisfactory descriptions difficult. The data in the above descriptions of leaves and leaf structure have been drawn from the best developed leaves obtainable. The sinuous exothecial cell walls, the *orthotrichoid* but simple peristome and the hair-pointed leaves enable one to recognize the genus easily, but the species intergrade in many particulars in a most puzzling way, especially as there is so great a variation in the leaves of a single plant. *F. pusilla* might be regarded as one extreme of a series ending at the other extreme in *F. Ravenelii.*

6. FABRONIA IMPERFECTA Sharp, Bryol. **36**: 20. 1933.
(Description quoted.)

"Plants delicate, green (sometimes graying upon drying); found growing in densely interwoven mats resembling velvet. Stems creeping; branches many, erect, short and julaceus. Leaves imbricate-spreading

(ovate to) obovate, concave, costate to about the middle; apices piliferous; margins serrate to dentate with projecting cells (or nearly entire). Cells of the basal angles quadrate; in the upper part of the leaf, short elliptical; in the hair, long and slender. Perichaetial leaves somewhat more lanceolate, ecostate. The sporophyte differs from the other North American species only in the matter of peristome. Teeth none or one to five, irregularly placed, small, hyaline or very pale yellow, often imperfect and truncate. Oral membrane none. Spores green, 10–15 μ in diameter." *Pl. 71.*

When sterile scarcely to be distinguished from forms of *F. Bartramii;* leaves about 0.5 mm. long, median leaf cells oblong-hexagonal, about 12 μ wide, 2.5–3 : 1. Capsule pyriform; operculum conic-apiculate; peristome of 1–5 teeth, irregularly placed. The exothecial cells are less sinuose than in *Bartramii* and there are 3–5 rows of narrow cells at mouth of urn, spores in early winter. N. Am. Musci Pl. Suppl. 42. *Pl. 71.*

"Type: On the bark of an American Elm (*Ulmus americana*) on the F. F. Van Deventer estate, 862 Temple Ave., Knoxville, Tennessee, alt. 950 ft., Dec. 27, 1932. The type material is deposited in the herbarium of The University of Tennessee."

Plants of this species with immature sporophytes were found earlier on a slate cliff at Kinzel Springs, Blount Co., Tennessee, alt. 1200 ft. Oct. 23, 1932. This material also is to found in The University of Tennessee herbarium.

In gross appearance this species does not differ materially from the other North American species of *Fabronia.*

FABRONIA DONNELLII Aust. Bot. Gaz. **2**: 111. 1877.

What is almost certainly cotype, if not the type, was found in the John Donnell Smith herbarium in the U. S. National Museum. The specimen was exceedingly small and had but one (imperfect) capsule.

It was found "Growing with *Macromitrium, Didymodon* and *Rhynchostegium microcarpum* in crotch of recently felled white oak." "At a hammock 8 miles west of St. Augustine, Fla." John Donnell Smith. . . . the specimen was marked "All of it." J. D. S. This specimen was studied through the courtesy of Dr. W. R. Maxon of The National Museum. The amount is too small to make a satisfactory determination or comparison. Description follows.

Plants very small, with the appearance of slender *Sematophyllum adnatum* with unusually narrow leaves; leaves lanceolate to linear-lanceolate, a little less than 1 mm. long, gradually narrowed to a slender acumination, slightly concave; margins entire, plane or slightly reflexed near the base; costa lacking; median leaf cells oblong-linear, ± 8 μ wide, 6–8 : 1; at basal angles a patch of quadrate cells (6–8 on the margin), those at the insertion slightly inflated, hyaline or somewhat colored; perichaetial leaves nearly entire.

Seta about 4 mm. long; capsule oblong-ovoid, slightly inclined and unsymmetric; urn about 1 mm. long; no inner peristome seen but the single capsule was very old; teeth almost hyaline, strongly ridged at the back at the articulations (but not unusually so); exothecial cells rectangular, not collenchymatous or sinuous; a detached fragment of what resembled a portion of a segment of the inner peristome with a bit of basal membrane was observed.

If the leaves were at all serrulate I should refer it to *Brotherella,* near *B. tenuirostris* (Schimp.). It is not a *Fabronia.*

2. ANACAMPTODON Brid. Musc. Recent. Suppl. **4**: 136. 1819.

We have one species characterized by entire leaves, costate to beyond the leaf middle. Peristome double with teeth united in pairs and recurved when dry; segments filiform, shorter than the teeth, basal membrane lacking.

ANACAMPTODON SPLACHNOIDES (Froehl.) Brid. l. c. *pl. 2, f. 11.*

Orthotrichum splachnoides Froehl. in Brid. Sp. Musc. **2**: 4. 1812.

Plants in rather dense, thin, dark green, velvety mats; leaves ovate-lanceolate, rather gradually acuminate, reaching 1.5 mm. long, usually shorter, soft, somewhat concave, not decurrent, not plicate; margins plane and entire; costa extending to the middle or beyond; median leaf cells rhombic-hexagonal, about 12 μ wide, 3–5 : 1, a few at base quadrate to rectangular. Monoicous; seta 5–8 mm. long, light brown to chestnut; capsules brown to chestnut, erect and symmetric; urn about 1½–2 mm. long, oblong-ovoid, strongly constricted below the mouth when dry and empty; annulus none; operculum short-rostrate; peristome as described above; spores in June. Type locality, Ellwangen in Württemberg.

ILLUSTRATIONS:—Bry. Eur. *pl. 453;* Limpricht, Laubm. **2**: 733. *f. 338;* M. H. M. 386, *f. 210;* Jennings, Mosses Western Pa. *pl. 33.*

EXSICCATI:—Sull. Lesq. Musc. Bor. Am. (Ed. 1) 255, (Ed. 2) 379; Sull. Musc. Allegh. 82; Drumm. Musc. Am. 94 (as *Neckera*); Grout, N. Am. Musc. Pl. 148 & 401, Musci Perfecti 176.

In moist cavities in decaying wood, especially knotholes. Widely spread but local; Maine to Illinois, south to the Gulf States. Not yet reported from Florida.

Var. TAYLORIAE Grout, Bryol. 9: 44. 1906. (*Tyloriae* by error.)

Leaves almost evenly narrowed from base to apex, costa almost percurrent; capsules slightly larger and operculum scarcely more than conic.

The young leaves in the species are often ovate and acute rather than acuminate. While this moss usually occurs in small patches, I have found patches about a foot in diameter on rock maple shade trees in the village of Newfane, Vt. One patch was below a large split in a fork of the tree, where moisture collected and trickled down.

3. CLASMATODON Hook. & Wils. Journ. Bot. 4: 421. 1842.

A monotypic genus with leaf structure much like that of *Anacamptodon*, but with leaves and leaf cells smaller, much more numerous quadrate angular cells, and a single peristome of 16 irregular filiform teeth. The plants are usually found on the bark of trees and shrubs in the Southern States.

CLASMATODON PARVULUS (Hampe) Sull. Mosses U. S. 60. *pl. 5*. 1856.

Leskea parvula Hampe, Linnaea **13**: 46. 1830.
Fabronia Wrightii brachyphylla Kindb. Rev. Bryol. **22**: 92. 1895.

Plants in thin loosely interwoven mats, bright green in the younger parts, brownish below; stems creeping, slender, irregularly divided; branches short, filiform, 2–5 mm. long, erect, mostly simple, mostly julaceous with closely imbricate leaves, which, however are occasionally somewhat secund; leaves from creeping stems broadly lanceolate, long and slenderly acuminate; leaves from the middle of branches ovate, acute to acuminate, 0.5–0.7 mm. long, concave, not decurrent, with margins plane and entire or nearly so, recurved toward the base; costa reaching about to the leaf middle; median leaf cells oblong-rhombic, 8–10 μ wide, 2–3 : 1; a large triangular area of quadrate alar cells reaching nearly to the costa (much more numerous than shown in Sullivant's figure); perichaetial leaves sheathing, ecostate, the inner lanceolate. Monoicous; seta very slender, 3–4 mm. long; capsule erect and symmetric, ovoid to oblong-ovoid; urn (including neck) 0.75–1 mm. long; operculum rostrate; calyptra cucullate; annulus of 2–4 rows of small cells, adherent; peristome as described, the teeth sometimes not entirely separated; spores in winter to early spring, finely papillose. Type locality, Savannah, Georgia.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 79;* Limpricht, Laubm. **2**: 741. *f. 340;* Bry. Eur. *pl. 453* (as *Anisodon perpusillus*); *Pl. 69.*
EXSICCATI:—Drumm. Musc. Am. S. States 93 (as *C. pusillus* Hook. & Wils. 1841); Sull. Musc. Allegh. 80; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 246, (Ed. 2) 368; Aust. Musc. Appal. Suppl. 534; R. & C. Musc. Am. Sept. 82; Grout, N. Am. Musc. Pl. 231, Musci Perfecti 204.
On bark of trees and shrubs, rarely on rocks; common in the Gulf States, north to Oklahoma and Virginia.

Var. RUPESTRIS Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 246 b (name only); Lesq. & James Man. 298. 1884.

More densely tufted, stouter, leaves broadly ovate, obtuse to obtusely acute. Stem leaves in the type slenderly acuminate.

On rocks and trees. Type from Tennessee. Also in Pennsylvania.
From Texas Prof. F. McAllister sends a very robust form, the young branches a light yellowish green, with the leaves loosely imbricate, erect-open, very broad and 0.6–0.7 mm. long; stem leaves acute to short-acuminate. This is so distinct as to indicate a new species except for intergrading forms.

4. HABRODON Schimp. Syn. (Ed. 1) 505. 1860.

A genus of two species, of which one occurs in Europe and has been reported from North America, the other in Japan. Exceedingly slender, resembling in gross appearance a *Fabronia* or an *Amblystegiella*, but with leaves like miniature *Leucodon*. Indeed the leaf structure is difficult to distinguish from that of the flagella of *L. julaceus flagelliferus* and the author is inclined to believe that genuine *Habrodon perpusillus* (De-Not.) Lindb. does not occur in North America. No one has collected it since Sullivant's collection in Ohio. Specimens collected by Dr. Hague in Illinois were found mixed with *Leucodon julaceus* and have since been determined as flagella of that species. The resemblance is very close but the leaves of the *Leucodon* have in the median basal area a greater area of more elongated cells and the apical cells are elongated, while those of *Habrodon* are almost circular. The leaves in *Habrodon* are much more uniform than in *Leucodon*, in

which there are usually great differences in the basal and apical leaves of a flagellum. A photograph and a slide of Sullivant's original material have been loaned by the Farlow Cryptogamic Herbarium of Harvard University; these fully confirm the opinions expressed above.

5. MYRINIA Schimp. Syn. (Ed. 1) 482. 1860.

Tree growing mosses with the habit and appearance of *Leskea polycarpa;* tufts dark green; plants slender, without brood bodies; stems creeping, with few radicles; branches short and erect, not flagelliform; leaves spreading when moist, appressed when dry, acute to obtuse, entire; costa short, often thin; leaf cells oblong above, median rhombic, gradually longer toward the leaf base, rhombic-quadrate at basal angles and margins. Capsules erect or inclined, oblong-cylindric, nearly or quite symmetric, contracted under the mouth when dry; operculum conic; annulus lacking; peristome well developed, double with keeled segments as long as teeth and from a narrow basal membrane, cilia lacking. Type species *M. pulvinata.*

Myrinia pulvinata (Wahlenb.) Schimp. Syn. (Ed. 1) 483. 1860.

Leskea pulvinata Wahlenb. Flor. Lapp. 369. 1812.

Stem leaves ovate to broadly ovate-lanceolate, 0.7–1 mm. long; median leaf cells 12–15 x 25–45 μ; inner perichaetial leaves linear-lanceolate, sheathing, reaching 2 mm. in length, narrowly obtuse. Other characters as above.

Illustrations:—Bry. Eur. *pl. 471; Pl. 59.*

Bases and roots of trees. A very rare moss of high altitudes and latitudes. British Columbia and northern Canada; Tobique River and Lac Bean, St. Francis River, New Brunswick.

Myrinia (?) Dieckii R. & C. Bot. Centralbl. **44**: 421. 1890.

This is not a *Myrinia* at all but a *Hygrohypnum* near *H. Smithii* (Sw.) Broth. The leaves are rather narrower, ovate to broadly ovate, none apparently sub-circular. Otherwise it agrees quite closely. A specimen at the New York Botanical Garden, apparently from the type collection, Mt. Hood, Oregon (Roell) has been studied. Until better and more abundant material is at hand it is scarcely worth while to attempt naming it.

6. SCHWETSCHKEOPSIS Broth. Engler & Prantl, Musci (Ed. 1) 877. 1907.

Only one species occurs in our range.

Schwetschkeopsis denticulata (Sull.) Broth. l. c.

Leskea denticulata Sull. Musc. Allegh. 62. 1845.

Plants small and very slender, in thin tufts, pale green, soft; stems prostrate, 2–4 cm. long, irregularly branched, without paraphyllia or central strand, somewhat flattened to subjulaceous; stem leaves close, erect-spreading, concave, very slightly decurrent, ovate to ovate-lanceolate, somewhat abruptly short-acuminate, 0.5–0.7 mm. long, mostly *without any traces of costa;* margins plane, slightly denticulate; branch leaves smaller, more gradually acuminate to acute; median leaf cells oblong-oval to oblong-linear, $\pm$ 7 μ wide, 2–4 : 1, *unipapillate on dorsal surface;* alar abruptly quadrate and short-rectangular, occupying nearly the entire leaf base; marginal row quadrate to rhombic, extending nearly to base of acumination. Dioicous; seta smooth, 4–8 mm. long; capsule oblong-ovoid, nearly or quite erect and symmetric, 2–3 : 1; operculum rostrate; *annulus lacking;* peristome without cilia, the segments nearly as long and wide as the teeth, more or less open between the joints; calyptra cucullate. Type locality, Balsam Mt., N. Carolina. Type in the Herbarium of Harvard University.

Illustrations:—Sull. Icones Musc. *pl. 78;* M. H. M. *pl. 58.*

Exsiccati:—Drumm. Musc. Am. S. States 86 (as *Pterogonium filiforme* var. ?; Aust. Musc. Appal. 267; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 245, (Ed. 2) 347; R. & C. Musc. Am. Sept. Exsic. 85; Grout, N. Am. Musc. Pl. 134.

On base of trees, occasionally on rocks, rarely fruiting; sometimes flagelliferous. Connecticut to the Mississippi River and south to the Gulf.

Family FONTINALACEAE*

By Dr. Winona H. Welch.

Plants aquatic, floating, attached at base of stems by a cushion of rhizoids, filiform to robust, colors ranging from various shades of green to reddish brown; some stems short but majority are much elongated, more or less denuded at base, irregularly or regularly pinnate; branches numerous, more or less fasciculate; leaves usually in three rows, distant to imbricate, costate or ecostate, more or less decurrent, subulate to almost orbicular, apices entire to microscopically denticulate, acute, subobtuse, obtuse, or more or less broadly obtuse; median leaf cells linear-rhomboidal or hexagonal-rhomboidal to linear-attenuate; alar cells rectangular, quadrate, or subhexagonal, auricles distinct to none. Dioicous (exceptionally monoicous or synoicous, according to Cardot); perichaetium oval, oblong, or cylindrical; calyptra cucullate or mitriform; capsule sessile or on seta of short to moderate length, completely immersed in the perichaetial leaves or partially or completely emergent, neck, annulus, and stomata lacking; operculum conical or rostrate; peristome double, the outer composed of 16 teeth, the inner of 16 cilia more or less completely united by transverse strands into a cone-like trellis.

The name is derived from the Latin, *fons, fontis*, fountain or spring. The family is truly called Water Mosses because the plants are submerged all the time or are attached to objects which are submerged during high water.

The family consists of six genera, three of which occur in North America north of Mexico.

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*Introductory Note.

The most complete study of the Fontinalaceae of North America was published in 1892 by Jules Cardot in Monographie des Fontinalacées. During the forty-two years which have passed, the collections of this group have increased greatly and the need of a revision of the family has become apparent. Cardot's monograph has served as a basis for the present study and all available specimens determined by Cardot have been carefully examined.

American students of mosses have had difficulty in using existing keys in Fontinalaceae because of the frequent use of fruiting characteristics in distinguishing the species and the varieties. Since many members of this family are rarely collected in fruit, I have made an attempt to prepare keys based upon vegetative distinctions, using the characteristics of the perichaetia and the capsules as additional differences in species which are rather frequently collected in the fruiting condition.

The study has been made in the Bryological section of the Long Island Biological Laboratory located at Newfane, Vermont, and in the Botanical Laboratories of DePauw University, Greencastle, Indiana.

Acknowledgments.

I am especially indebted to Dr. A. J. Grout for the suggestion of the problem, for his valuable advice and criticism, for the use of his large collection of Fontinalaceae, including Husnot, Musci Galliae, and Brotherus, Bryotheca Fennica, and for the arrangement of the illustrations and the preparation of the plates. For the courtesy of the loan of extensive collections of Fontinalaceae in their charge, I am very grateful to Dr. W. R. Maxon and Mr. E. C. Leonard of the United States National Herbarium, to Prof. G. E. Nichols and Prof. H. Castle of Yale University, to Prof. W. H. Weston and Mrs. Gertrude H. Riddle of the Farlow Herbarium, Harvard University, to Mr. R. S. Williams of the New York Botanical Garden, to the late Dr. M. O. Malte of the National Herbarium of Canada, to Mr. A. J. Sharp of the University of Tennessee, to Prof. C. L. Porter of the University of Wyoming, and to Dr. C. C. Deam, Bluffton, Indiana. A few of the important American exsiccati which have been available through these herbaria are Austin, Musci Appalachiani, Sullivant and Lesquereux, Musci borealo-americani, Sullivant, Musci Alleghaniensis, Grout, North American Musci Pleurocarpi, Grout, Musci Perfecti, Macoun, Canadian Musci, and F. Renauld and J. Cardot, Musci Americae Septentrionalis. I wish to express, also, my deep appreciation to Directeur Pierre Allorge of the Herbarium, Laboratoire de Cryptogamie, Muséum d'Histoire Naturelle, Paris, for the use of a large number of J. Cardot's types and duplicate types. My gratitude is due also to Dr. John Hendley Barnhart, New York Botanical Garden, for checking a large number of citations. For information concerning specific specimens I greatly appreciate the correspondence of Prof. T. C. Frye, University of Washington, Prof. J. C. Arthur, Purdue University, and the Rev. C. H. Demetrio, Memphis, Tennessee. I am especially thankful to Prof. T. G. Yuncker, DePauw University, for his very helpful suggestions, for the availability of the necessary laboratory equipment, and for the use of the Fontinalaceae of the J. P. Naylor Herbarium. To Mr. William D. Gray, a graduate student in Botany, DePauw University, I express my sincere thanks and appreciation for his splendid coöperation, care, accuracy, and skill in preparing the many drawings both original and copied.

The keys are based chiefly upon vegetative characteristics because the plants are collected very frequently without fruits. The family and the genera are rather easily recognized, especially if fruiting specimens are available, but the species are very difficult to separate because of the similarity in fruits and in the areolation of the leaves and the variation in leaf size and form on the same plant. So far as possible the use of characteristics which may be produced or modified by habitat conditions has been avoided. The decisions concerning relationships between species and varieties have been made very largely upon fruit characteristics whenever the fruits or the descriptions were accessible.

KEY TO THE GENERA OF FONTINALACEAE.

1. Leaves ecostate ..... *1. Fontinalis.*
   Leaves costate ..... 2.
2. Leaves narrowly lanceolate, secund to falcate-secund; perichaetium very long, cylindric; seta of medium length, longer or shorter than the perichaetium ..... *3. Dichelyma.*
   Leaves oblong-lanceolate, neither secund nor falcate-secund; perichaetium oblong; seta very short, completely immersed ..... *2. Brachelyma.*

1. FONTINALIS [Dill., L.] emend. Myrin, Act. Reg. Acad. Scient. Holm. 1832.

Plants aquatic, slender to very robust; stems usually denuded toward base, more or less elongated, freely branched; leaves tristichous, ecostate, carinate, keeled-conduplicate, concave, plane, or more or less canaliculate or tubular, shapes varying from nearly subulate or narrowly lanceolate to almost orbicular; apices entire, or microscopically subdenticulate or denticulate, acute, subobtuse to more or less broadly obtuse; median leaf cells linear or linear-rhomboidal; alar cells rectangular, quadrate, or subhexagonal, forming more or less distinct auricles; perichaetium oval, oblong, or cylindrical; perichaetial leaves oval to suborbicular or oval-oblong, truncate, rounded, or apiculate, entire, more or less lacerate with age. Capsule sessile, completely immersed to about one-half emergent; calyptra conical, base lacerate with age, extending to the base of the capsule or slightly below; operculum conical; peristome double, orange to brownish, outer peristome of 16 distinctly lamellate teeth, often united in pairs at the apex, inner peristome of 16 cilia, about same length as teeth, united by transverse strands into a cone-like trellis; spores varying in size, usually green, smooth or muricate.

KEY TO SECTIONS OF FONTINALIS.

1. Older cauline leaves typically keeled or keeled-conduplicate, younger cauline leaves and branch leaves keeled, keeled-conduplicate, or concave ..... *A. Tropidophyllae.*
   Neither cauline nor branch leaves keeled-conduplicate ..... 2.
2. Leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent ..... *B. Heterophyllae.*
   Leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present (except in *Novae Angliae*, var. *heterophylla*) 3.
3. Cauline leaves more or less concave or channeled, majority more or less firm ..... 4.
   Cauline leaves slightly concave or almost plane, majority more or less flaccid to very flaccid ..... *D. Malacophyllae.*
4. Cauline leaves ovate-lanceolate or oblong-lanceolate, some narrowly lanceolate .... *C. Lepidophyllae.*
   Cauline leaves linear-lanceolate ..... 5.
5. Plants very slender, very delicate, more or less filiform; leaves very concave, tubular, or subtubular ..... *F. Solenophyllae.*
   Plants slender, delicate, but scarcely filiform; leaves long and narrowly acuminate, more or less channeled ..... *E. Stenophyllae.*

Sect. A. TROPIDOPHYLLAE Card. Mon. Font. 48. 1892.

Older cauline leaves typically keeled or keeled-conduplicate, younger cauline leaves and branch leaves keeled, keeled-conduplicate, or concave, leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present, or leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent; perichaetium oval or oblong. With the exception of *F. antipyretica* var. *gigantea* the members of this section are more common in western United States and Canada than in the eastern part.

KEY

1. Leaves more or less uniform, cauline leaves and branch leaves similar with intergradations in shape or size present..... 2.
Leaves dimorphic, cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent..... 7.
2. Leaves with keels more or less curved above the basal curve.... 3.
Leaves with keels more or less straight above the basal curve; some apices more or less shortly and abruptly curved..... 6.
3. Leaves ovate, oval, or almost orbicular, 1–2 : 1; apices more or less broadly obtuse, those of the cauline leaves usually more or less abruptly narrowed, those of branch leaves generally gradually narrowed, some more or less cucullate..... 4.
Leaves oblong-lanceolate, oval-lanceolate, or ovate-lanceolate, 1.5–3 : 1; apices acute, subobtuse, or more or less narrowly obtuse..... 5.
4. Plants robust, cauline leaves 4–8 mm. long, 3–6 mm. wide..... 1a. *antipyretica*, var. *gigantea*.
Plants less robust, cauline leaves 3.5–5 mm. long, 1.5–4.5 mm. wide..... 1b. *antipyretica*, var. *mollis*.
5. Cauline leaves ovate-lanceolate or oval-lanceolate, 5–8 mm. long, 2–4 mm. wide, approximately 2–3 : 1; apices usually more or less obtuse, some acute, median leaf cells linear-rhomboidal, 6–15 : 1; perichaetial leaves oval or suborbicular, obtuse.... 1. *antipyretica*.
Cauline leaves oblong-lanceolate, 2.5–5 mm. long, 1–3 mm. wide, 1.5–3 : 1; apices frequently acute, some more or less obtuse, median leaf cells linear, 10–25 : 1; perichaetial leaves broadly oval-lanceolate, abruptly apiculate..... 2. *neo-mexicana*.
6. Cauline leaves lanceolate, 3.5–5 mm. long, 0.75–2 mm. wide, 2.5–4 : 1; apices gradually narrowed, more or less obtuse and conduplicate..... 1c. *antipyretica*, var. *oreganensis*.
Cauline leaves ovate-lanceolate, 4–6 mm. long, 1.5–2.5 mm. wide, 2–3 : 1; apices more or less abruptly narrowed, short, broad, and open..... 1d. *antipyretica*, var. *patula*.
7. Cauline leaves narrowly lanceolate, narrowly acuminate, 4–5.5 mm. long, 0.50–1 mm. wide, 6–8 : 1; branch leaves very narrowly lanceolate, long and narrowly acuminate, almost awl-shaped, 3–5 mm. long, 0.25–0.60 mm. wide, 8–18 : 1..... 5. *chrysophylla*.
Cauline leaves broadly ovate-lanceolate or oval-lanceolate; branch leaves narrowly lanceolate, narrowly ovate-lanceolate or oblong-lanceolate..... 8.
8. Plants more or less dendroid in appearance; upper cauline leaves more or less shortly and narrowly acuminate, 5–7 mm. long, 1.5–3 mm. wide, 2–3 : 1; branch leaves narrowly lanceolate, long-acuminate, canaliculate or more or less tubular toward apex, 3–4 mm.long, 1–1.5 mm. wide, 3–4 : 1..... 4. *Howellii*.
Plants not dendroid in appearance; upper cauline leaves more or less longly and narrowly acuminate, 5–7 mm. long, 1.5–3 mm. wide, 1.5–3 : 1; branch leaves narrowly ovate-lanceolate or oblong-lanceolate, long-acuminate, canaliculate toward apex, 3–6 mm. long, 1–2 mm. wide, 2–3 : 1..... 3. *Kindbergii*.

1. FONTINALIS ANTIPYRETICA [L.] Hedw. Sp. Musc. 298. 1801.

Fontinalis trifaria Voit. Muscol. Herb. 125. 1812.
Pilotrichum antipyreticum C. Müll. Syn. **2**: 148. 1850.

Fontinalis californica Sull. Pacif. R. R. Rep. **4:** 189. 1857.
Fontinalis antipyretica L., var. *californica* (Sull.) Lesq. ms. in herb., according to Cardot.

Plants more or less slender, commonly dark green, glossy or dull, sometimes yellowish-green, olive-green, brownish-green, coppery brown, golden-brown, may become blackish with age; stems usually more or less rigid, up to 50 cm. in length, rarely 70 cm., generally denuded at base; branching pinnate, generally more or less flaccid if young and long; *leaves spreading* or loosely imbricate at ends of stems and branches, *usually more or less distant*, 1–2 mm. apart, *keeled-conduplicate with keel commonly curved, oval- or ovate-lanceolate*, variously acuminate, apices usually more or less obtuse, some acute, entire, sinuolate, or denticulate, with *margins on one side* (seldom both sides) *frequently reflexed near base*, 5–8 mm. long, 2–4 mm. wide, approximately 2–3 : 1; *median leaf cells linear-rhomboidal to hexagonal*, 10–15 μ wide, 6–15 : 1; alar cells enlarged, more or less rectangular, quadrate, or hexagonal, sometimes as many as 13 vertical rows of cells in the alar group, walls yellowish or brown, generally forming distinct auricles; perichaetial leaves oval or suborbicular, obtuse, entire, usually lacerate with age. Capsule usually immersed, rarely half emergent, *more or less oval*, 2–3 mm. long, 1–1.5 mm. in diameter; operculum short-conical, about 1 mm. long; peristome orange-brownish, teeth linear, approximately 1 mm. long, often united in pairs at the apex, papillose, with 25–35 lamellae; inner peristome perfect, papillose, transverse bars more or less appendiculate; spores olive-green or yellowish-green, slightly muricate, 15–18 μ in diameter, ripe in summer. Type locality, Europe.

Illustrations:—Bry. Eur. *pl. 429;* Limpr., Laubm. **3:** *figs. 325 & 326;* Engler & Prantl (Ed. 2) **11:** *fig.* 474; Arkiv för Botanik **17,** No. 14, *figs. 1 & 2;* M.H.M. *pl. 88a*; *Pl. 74.*
Exsiccati:—*Sull. & Lesq.* Musci Bor. Am. (Ed. 2) 333; *Foster,* 1430, Ore.; *Baker,* 3000, Cal.; *Bolander,* 333, 952, Cal.; *Grout,* Tolland, Colo., July 28, 1914; *Wright,* 334, N. Mex.; (*Macoun?*), Canadian Musci, 228.
In ponds and streams, United States and Canada. According to Cardot, also in Greenland, Europe, Asia, and Africa. The varieties of *antipyretica* are more common in North America than is the species. All varieties, except *gigantea*, occur more frequently in western United States and Canada than in the eastern part.
The species may be distinguished by leaves generally more or less distant, keeled-conduplicate with keels commonly curved, oval- or ovate-lanceolate, approximately 2–3 : 1, margins on one side frequently reflexed near base, many apices short and more or less narrow, obtuse, denticulate; median leaf cells short, linear-rhomboidal to hexagonal, and capsules oval or oval-oblong.
According to Cardot, Linnaeus gave the specific name *antipyretica* to this moss because the peasants of Sweden surrounded the chimneys of their houses with it for the prevention of fire.

1a. Var. GIGANTEA Sull. Icon. Musc. 106. 1864.

Fontinalis gigantea Sull. Musci U. S. 104. 1856.
Fontinalis antipyretica L., var. *robusta* Card. Rev. Bryol. **9:** 88. 1882.

Plants moderately to very robust, green, brownish-green, golden-green, or copper-brown; *cauline leaves more or less imbricate* or erect-spreading, *keeled-conduplicate, keel commonly curved, ovate, broadly ovate, lance-ovate, oval, or almost orbicular, frequently margins on one side reflexed near base*, large, 4–8 mm. long, 3–6 mm. wide, approximately 1–2 : 1; apices gradually or more or less abruptly narrowed, *usually more or less broadly obtuse*, sometimes acute, entire, subdenticulate, or denticulate; median leaf cells 10–20 μ wide, 7–11 : 1; *peristome teeth smooth or only slightly papillose;* trellis of inner peristome often imperfect, slightly muricate, transverse bars not appendiculate or only slightly so.
Type locality, New England.

Illustrations:—Sull. Icon. Musc. *pl. 66;* Grout, M.H.M. *pl. 88d; Pl. 74.*
Exsiccati:—*Austin,* Musci Appal. 243; *Sull. & Lesq.* Musci Bor. Am. (Ed. 1) 224, (Ed. 2) 335 in part; *Grout,* N. Am. Musc. Pl. 137, Conn., 281, Vt.; *Delamare,* R. & C., Musci Am. Sept. 71, Miquelon; *G. K. Merrill,* 184, Me.; *E. D. Merrill,* Flora of Maine, 68; *Welch,* 711, Vt.; *Grout,* Cold Spring Harbor, N. Y., July 5, 1929; *E. G. Britton,* Pa., July 3, 1899; *Burnett & Gates,* 1704, Pa.; *Small,* Pa. Mosses, Sept. 2–5, 1889; *Holzinger & Elftman,* Mosses of northern Minn., June 21, 1897; *Aven Nelson,* 8521, Wyo.; *Heller,* Idaho Plants, 3450; *Allen,*Mosses of Cascade Mts., 82, Wash.; *Macoun,* Canadian Musci, 598a, N. S.; 757, Ont.; 3, Vancouver Id.; *Waghorne,* Canadian Musci, Nfld., July 24, 1890.
In streams and ponds, Canada, Miquelon, and northern United States across the continent. Europe. According to Jennings (Manual Mosses of Western Pennsylvania), also in "Asia, northern Africa and from Canada through the United States to Alabama." I have seen no specimens collected south of Pennsylvania. From specimens examined, I have concluded that var. *gigantea* occurs more frequently in eastern United States than in the western part.
The var. *gigantea* differs from *antipyretica* in being commonly more robust, cauline leaves usually closely imbricate or subimbricate, ovate, oval, or almost orbicular, and apices more or less broadly obtuse.

1b. Var. MOLLIS (C. Müll.) **n. comb.**

Fontinalis mollis C. Müll. Bot. Centralbl. **44:** 421. 1890.

Plants more or less slender, green, yellowish-green; stems more or less soft, slightly denuded below, irregularly pinnate; cauline leaves erect-spreading or loosely imbricate, *keeled-conduplicate or very concave with keels curved, ovate, oval, or almost orbicular,* with apices gradually narrowed or more or less abruptly narrowed, obtuse to more or less broadly obtuse, sometimes slightly cucullate to cucullate, entire, sinuolate, subdenticulate, or denticulate, 3.5–5 mm. long, 1.5–4.5 mm. wide, 1–2 : 1; median leaf cells linear-rhombic, 10–17 μ wide, 6–15 : 1; alar cells enlarged, rectangular, quadrate, or subhexagonal, greenish, yellowish, brownish, brown, or yellowish-brown, frequently forming distinct auricles. According to C. Müller and Cardot, the upper perichaetial leaves are oval-suborbicular, truncate, lacerate at apex with age. *Capsule* completely immersed, *oval,* 1.75–2 mm. long, 1 mm. in diameter; operculum obtuse, conical; peristome orange-brownish, teeth linear-acuminate, about 1 mm. long, slightly papillose, with 28–32 lamellae, usually united in pairs at apex; inner peristome imperfect, muricate, transverse bars nodulose or appendiculate, usually incomplete; spores green, slightly muricate.

Type locality, Astoria, Washington; collected by Röll.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—*Röll,* 292, Astoria, Wash., type or duplicate type in Herbarium of the New York Botanical Garden; *Foster,* 439B, Wash.; *Aven Nelson,* Plants of Wyoming, 9670; *Porter,* Bryophytes of Wyoming, 1437; *Macoun,* Canadian Musci, 598e, Vancouver Id.

In rivers, in western United States and Canada.

This variety differs from *antipyretica* in having leaves ovate, oval, or almost orbicular, apices broad, obtuse, frequently more or less cucullate; from var. *gigantea* in plants commonly less robust, leaves usually smaller, frequently more or less cucullate.

F. antipyretica var. *pseudomollis* Card. has been found on one collection. The name is not considered as a synonym because no publication of the description has been found. The specimens are included in the exsiccati of *F. antipyretica* var. *mollis.*

F. patens Card. and *F. antipyretica patens* R. & C. occur on packets of material collected in same locality. The names have been omitted from synonymy after a careful search in literature for the descriptions. The plants agree with the description of *F. antipyretica* var. *mollis* and have been included in the exsiccati of this variety.

Fontinalis utahensis Card. & Thér. Arch. de Bot. **1:** 67. *f.* 1. 1927. No material of this species has been obtainable. From a study of the original descirption I have concluded that it seems to be more closely related to var. *mollis* than to the other species in this section.

1c. Var. OREGANENSIS R. & C. Rev. Bryol. **15:** 71. 1888.

Fontinalis rigens Ren. & Card. Bot. Centralbl. **44:** 421. 1890.

Many plants slender, some more or less robust, golden, yellowish-green, brownish-green, olive-green, of copper-color, usually glossy in upper portions and dull in lower; stems more or less flaccid and foliate to base when young, more or less rigid and denuded at base when older, pinnately branched; branches distant, spreading; leaves firm, rather distant, spreading or erect-spreading, imbricate toward ends of stems and branches, *keeled-conduplicate with keels not curved above basal curve or only slightly so,* some shortly and more or less abruptly curved at apex, some with one or both margins reflexed near base, *lanceolate, gradually narrowed toward apex,* many apices obtuse or subobtuse, some acute, many denticulate, some entire, 3.5–5 mm. long, some 6.5 mm. in length, 0.75–2 mm. wide, few 2.5 mm. in width, 2.5–4 : 1; *median leaf cells linear,* 6.5–13.5 μ wide, 8–16 : 1; alar cells enlarged and very evident, sometimes as many as 13 vertical rows, rectangular to subhexagonal, walls brown or yellowish-brown, frequently forming distinct auricles; fruits similar to those in *antipyretica,* except capsules frequently ⅓ emergent, and constricted beneath mouth when dry.

Type locality, Oregon; collected by Th. Howell.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—*Howell,* 19, Oregon, in swamps on roots of trees, etc., top of Coast Mts., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Grout,* N. Am. Musc. Pl. 210, 437, Washington, and 91, 140, British Columbia; *Foster,* 747, 907c, 1529, Wash.; *Nelson,* Flora of Wyoming, 2619; *Spreadborough,* Plants of Queen Charlotte Islands, Canada, 83366; *Hill,* July 10, 1903, B. C.; *Mr. & Mrs. E. P. Walker,* Bryophytes of Alaska, 902; *Macoun,* Canadian Musci, 9, 598d, Vancouver Id.; 208, B. C.

In swamps, sloughs, pools, ponds, and canals, in western United States and Canada, and in Alaska.

This variety differs from *antipyretica* in leaves usually shorter, narrower, 2.5–4 : 1, lanceolate, gradually narrowed toward apex, keels straight or only slightly curved, median leaf cells linear.

I have examined *Fontinalis angustifolia* Card. sp. nova, collected by Foster, no. 907b, in Quiniault Indian Agency, Washington, May 24, 1909. I consider the material as belonging to *F. antipyretica*, var. *oreganensis*. The search for the original description was unsuccessful.

I have studied material labeled *Fontinalis Fosteri* Cardot sp. nova, no. 1821, which was collected by Foster on margin of Lake Crescent, Wash., Aug. 11, 1911. I consider the plants as belonging to *F. antipyretica*, var. *oreganensis*. I have been unable to locate the original description.

id. Var. PATULA (Card.) **n. comb.**

Fontinalis patula Card. Rev. Bryol. **23**: 67. 1896.

Plants more or less robust, green, yellowish-green, or brownish, more or less glossy; stems more or less rigid, 20–25 cm. in length, foliate to base or slightly denuded, irregularly branching; branches more or less elongate; leaves spreading or erect-spreading, distant, more or less imbricate at ends of stems and branches, *keeled-conduplicate, or carinate and open, or concave, keels or median lines straight above basal curve or only very slightly curved*, some shortly and more or less abruptly curved at apex, many leaves split along keel, ovate-lanceolate to broadly ovate-lanceolate, *apices broad and short, majority more or less open*, acute, subobtuse, obtuse, entire to denticulate, 4–6 mm. long, 1.5–2.5 mm. wide, 2–3 : 1, in robust plants some leaves up to 7.5 mm. in length, 4 mm. in width, 1.5–2.5 : 1; *median leaf cells linear*, 8.5–15 μ wide, up to 24 μ in width in robust plants, 10–20 : 1; alar cells enlarged, subrectangular, rectangular, or subhexagonal, brownish or yellowish-brown. According to Cardot, the perichaetial leaves broadly ovate-suborbicular, apices rounded, lacerate with age; *capsule* immersed, *oblong-subcylindric*, 2.5–3 mm. long, 0.75–1 mm. in diameter, operculum obtuse-conical; peristome orange-brownish, teeth linear, up to 1.5 mm. in length, often united in pairs at apex, slightly papillose, *40-50 lamellae;* inner peristome perfect, muricate, lower transverse bars appendiculate; spores green, minutely granulose.

Type locality, Vancouver Island, Canada, "On stones in the Colquity River near Victoria"; collected by Macoun, May 25, 1893.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—*Macoun*, Colquity River, near Victoria, B. C., May 25, 1893, assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Macoun*, Canadian Musci, 208, 368, B. C., 104, Vancouver Id.; sheet no. 3928 in National Museum of Canada, V. I.; *Grout*, N. Am. Musc. Pl. 158, B. C.; 144, Wash.; *Piper*, 37, Wash.; *Grant*, Marysville, Wash., July, 1927.

In rivers, lakes, or pools, in Washington and British Columbia.

This variety differs from the species in keel straight above basal curve or almost so, apices broad, short, and usually more or less open, capsules oblong-subcylindric, some peristome teeth longer, and lamellae more numerous.

I have studied material labeled *Fontinalis Fosteri* Cardot sp. nova, no. 1046, which was collected by Foster in Mt. Rainier National Park, Wash., Aug. 9, 1909. I consider the specimens as *F. antipyretica*, var. *patula*.

2. FONTINALIS NEO-MEXICANA Sull. & Lesq. Musc. Bor. Am. (Ed. 1) No. 224b. 1856.

Fontinalis mercediana Lesq. Proc. Cal. Acad. **1**: 28. 1868.
Fontinalis columbica Card. Rev. Bryol. **18**: 82, 84. 1891.
Fontinalis neo-mexicana Sull. & Lesq., var. *columbica* Card. Mon. Font. 61. 1892.

Plants slender, dull green, vivid green, or yellowish, sometimes golden brown, brownish, or blackish, frequently glossy when dry; stems more or less rigid, 20–50 cm. long, denuded and blackish at base with age, pinnately branched; branches numerous, more or less flaccid, spreading or ascending; leaves commonly rather close, sometimes more or less distant, imbricate at ends of stems and branches, firm, spreading or erect-spreading, *keeled-conduplicate, keel slightly curved* and often split, *oblong-lanceolate*, with *many apices acute*, some more or less obtuse, entire or denticulate, 2.5–5 mm. long, 1–3 mm. wide, 1.5–3 : 1; *median leaf cells linear*, 5–15 μ wide, 10–25 : 1; alar cells slightly enlarged, sometimes as many as 8 vertical rows of cells in the alar group, rectangular to quadrate, walls hyaline to yellowish in younger leaves and brown to ferruginous in older leaves; *upper perichaetial leaves broadly oval-lanceolate, abruptly apiculate*, lacerate with age. Capsule immersed, *ovate-oblong*, 2–2.5 mm. long, 1–1.25 mm. in diameter; operculum conical, obtuse; peristome teeth orange-brownish, 20–25 lamellae, very papillose, trellis of inner peristome perfect, papillose, many transverse bars appendiculate.

Type locality, New Mexico; collected by Wright.

ILLUSTRATIONS:—Sull., Icones Musc. *pl. 57; Pl. 73 & 74.*

EXSICCATI:—*Austin*, Musc. Appal. 251b, N. Mex.; *Sullivant & Lesquereux*, Musc. Bor. Am. (Ed. 1). 224b, duplicate type, (Ed. 2) No. 334; *Grout*, N. Am. Musc. Pl. 84, B. C. and 263, Mont.; *Allen*, Mosses Cascade Mts., 80, Wash.; *Piper*, 83, Wash.; *Bailey*, B. C., June, 1907; Wash., Sept. 1, 1907; *Grant*, Wash., October, 1926; *Foster*, 439, 967, Wash.; Clackamas Co., Ore., June 17, 1907; *Craig*, 14, Ore.; *M. A. Howe*, R. & C., Musc. Am. Sept. 314, Cal.; *Elmer*, Idaho, June, 1899; *MacFadden*, 8910, Cal.; 1116, B. C.; Slocan Lake, B. C., April 7, 1926; *Umbach*, 869, Mont.; *Aven & Elias Nelson*, 6293, Wyo.; *Aven Nelson*, Bryophytes of Wyoming, 6293, 9669; Flora of Wyoming, 8511; *Goodding*, Plants of Colorado, 1851; *Standley*, National Forest, N. Mex., July 30, 1908; *Macoun*, Canadian Musci, 103, 599, B. C.; *Spreadborough*, 83367, Queen Charlotte Islands, Canada.

In streams of the Rocky Mountain and Pacific Coast states.

F. neo-mexicana differs from *F. antipyretica* in the leaves ovate-lanceolate, apices commonly acute, the upper perichaetial leaves broadly oval-lanceolate and abruptly apiculate.

Fontinalis maritima C. Müll. Flora **70:** 225. 1887.

Cardot in Monographie des Fontinalacées, page 62, suggested that *F. maritima* might be a variety of *F. neo-mexicana*. My efforts to obtain authentic material of *F. maritima* have been unsuccessful. Prof. T. C. Frye, Dep't of Botany, University of Washington, stated in a letter, June 6, 1933, that in 1914 he camped for one week at Neah Bay with the express purpose of collecting this moss and that he found nothing like it in the sea water. I have not seen the type or any specimen determined by Cardot as being *F. maritima*. From Cardot's description I have assumed that *F. maritima* might be a synonym or a variety of *F. neo-mexicana* and that the plant might have floated down from fresh water.

3. FONTINALIS KINDBERGII R. & C. Bot. Gaz. **15:** 58. 1890.

Fontinalis antipyretica L., var. *ambigua* Card. Rev. Bryol. **18:** 82. 1891.
Fontinalis subbiformis R. & C. in litt., according to Cardot.
Fontinalis Kindbergii R. & C., f. *robustior* Card. Mon. Font. 64. 1892.
Fontinalis Kindbergii R. & C., f. *gracilior* Card. Mon. Font. 65. 1892.

Plants more or less robust, ferruginous, golden, reddish, or copper-color, glossy above; stems more or less rigid, up to 30 cm. or more in length, commonly denuded and blackish near the base, more or less pinnately branched; branches erect or spreading, more or less rigid, *commonly plumose; leaves dimorphic; keels straight above the basal curve or only slightly curved*, sometimes a short and more or less abrupt curve at the apex; cauline leaves erect-spreading or loosely imbricate, more or less distinctly carinate or only folded, more commonly open than conduplicate, *broadly ovate-lanceolate or oval-lanceolate, more or less long and narrowly acuminate*, apices acute or obtuse, entire or denticulate, sometimes margins on both sides slightly involute, the upper 5–7 mm. long, usually 1.5–3 mm. wide, some up to 4 mm. in width, 1.5–3 : 1, the lower smaller and shorter-acuminate; branch leaves erect-spreading, rarely imbricate, concave, folded or subcarinate, *canaliculate toward apex, narrowly ovate-lanceolate or oblong-lanceolate, long-acuminate, margins slightly involute*, 3–6 mm. long, 1–2 mm. wide, 2–3 : 1; *median leaf cells linear-rhomboidal to linear*, 8.5–20 μ wide, 10–25 : 1; alar cells enlarged, more or less rectangular, quadrate, or hexagonal, walls yellowish or brownish, generally forming distinct auricles; perichaetial leaves suborbicular, apices rounded, entire, usually lacerate with age. *Capsule* immersed, *oblong to subcylindric*, 2–2.5 mm. long, 0.5–0.9 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear, slightly papillose, with 20–35 lamellae; lattice cone of inner peristome perfect, papillose, transverse bars appendiculate; spores yellowish-green, muricate, 15–18 μ in diameter.

Type locality, Vancouver Island (*Macoun*).

ILLUSTRATIONS:—Bot. Gaz. **15:** *pl. 9A;* Arkiv. för Botanik **17,** no .14, *figs. 15 & 16, pl. 6*, no. 11; *Pl. 73.*

EXSICCATI:—*Allen*, Mosses Cascade Mts., 81a & 81b, Wash.; *Foster*, 1045; 1428 in part, 1429, Wash.; *Piper*, 37, Wash.; *Macoun*, Canadian Musci, 133, 233, 251, 598b, Vancouver Id.; 598, N. S.; *J. W. Bailey*, Cumberland, B. C., June, 1901.

In streams, lakes, and ponds of United States and Canada, in and west of the Rocky Mountains; also in Nova Scotia. Europe.

This species differs from *antipyretica* in the branches usually more or less plumose, the leaves dimorphic and more or less long and narrowly acuminate, the keels straight above the basal curve or only slightly curved, and the capsules narrower, oblong to subcylindric.

The robust forms are distinguished by Cardot as forma *robustior* and the slender forms as var. *gracilis* and forma *gracilior*. I have been unable to obtain type material of this variety and these forms. As these names indicate, there is a wide variation in the size of the plants and the leaves. However, since aquatic mosses are frequently modified in size and form by changes in the habitat, I have placed *F. Kindbergii* Ren. & Card., f. *robustior* Card. and *F. Kindbergii* Ren. & Card., f. *gracilior* Card. in synonymy. Since I have found *F. Kindbergii* Ren. & Card., var. *gracilis* Card. on herbarium packets and not in print, I have omitted this name in the synonyms.

4. Fontinalis Howellii R. & C. Bot. Gaz. **13**: 200. 1888.

Plants rigid, yellowish green or dull green, *more or less dendroid* in appearance; stems 10–20 cm. long, rigid, subligneous, denuded below, pinnate to bipinnate; *branches spreading, commonly very plumose, generally arcuate; leaves firm and very dimorphic; cauline leaves* gradually larger toward the top of the innovations, commonly erect and imbricate, *broadly ovate-lanceolate, more or less short and narrowly acuminate,* carinate, subcarinate, concave or only plicate, with apices entire or subdenticulate, often slightly cucullate or lacerate; upper leaves 5–7 mm. long, 1.5–3 mm. wide, 2–3 : 1; lower leaves much smaller; *branch leaves narrowly lanceolate; long-acuminate, canaliculate or more or less tubular toward apices,* concave, not carinate, rigid, erect-spreading, 3–4 mm. long, some up to 6 mm. in length, 1–1.5 mm. wide, 3–4 : 1; median leaf cells linear, attenuate, 8.5–17 μ wide, 15–25 : 1; alar cells enlarged, quadrate, rectangular, or subhexagonal, yellowish, brownish, or ferruginous. According to Renauld and Cardot, the perichaetial leaves are oval, rounded or truncate at apex, finally lacerate; *capsule* immersed, *oblong or subcylindric,* 2 mm. long, 0.50–0.75 mm. in diameter; operculum unknown; teeth about 1 mm. long, narrow, linear-acuminate, slightly papillose, often connected in pairs at the apex, with 20–30 lamellae; trellis of the inner peristome strongly papillose, the lower transverse bars appendiculate.

Type locality, Oregon; collected by Th. Howell.

Illustrations:—Bot. Gaz. **13**: *pl. 18; Pl. 73.*

Exsiccati:—*Howell,* 20, Ore., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; 33, Ore.; *Allen,* near Mt. Rainier, Wash., Feb. 11, 1898; *Flett,* Mt. Rainier, Wash., July 26, 1914.

In pools, ponds, and swamps, in Oregon and Washington.

F. Howellii resembles *F. Kindbergii* rather closely. *F. Howellii* is usually very rigid, more or less dendroid in appearance, branches frequently arcuate, dimorphism is very pronounced, the broadly ovate-lanceolate cauline leaves are more or less shortly and narrowly acuminate, and the branch leaves are canaliculate or more or less tubular toward the apices.

5. Fontinalis chrysophylla Card. Rev. Bryol. **18**: 82 & 84. 1891.

Plants more or less slender, glossy, ferruginous, reddish, or golden yellow, sometimes brownish below; stems more or less rigid, approximately 15–20 cm. in length, denuded near the base, pinnately branched; branches spreading, plumose; leaves remote, firm, spreading or erect-spreading, *slightly dimorphic,* concave, subcarinate, carinate, or keeled-conduplicate, *median line usually straight above the basal curve* or almost so; apices obtuse, subobtuse, or acute, entire, subdenticulate, or denticulate; *cauline leaves narrowly lanceolate, narrowly acuminate,* 4–5.5 mm. long, 0.50–1 mm. wide, 6–8 : 1; *branch leaves and leaves of the innovations very narrowly lanceolate, longly and narrowly acuminate, almost awl-shaped,* some of the apices canaliculate, some tubular, some almost plane, 3–5 mm. long, 0.20–0.60 mm. wide, 8–18 : 1; median leaf cells linear, 6.8–8.5 μ wide, 15–30 : 1; alar cells enlarged, quadrate, subrectangular, subhexagonal, brown or yellow, forming distinct auricles. According to Cardot, the *capsule* is completely immersed, *oblong to subcylindric.*

Type locality, Washington, Olympic Mts.; collected by L. F. Henderson.

Illustrations:—*Pl. 74.*

Exsiccati:—*Henderson,* 1907, Wash., Olympic Mts., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Foster,* near Summit, Wash., 4807 in Herb. of E. B. Chamberlain now in Farlow Herbarium, also in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris.

In mountain bogs and streams, Washington.

This species differs from *F. Kindbergii* in all leaves remote, erect-spreading or spreading, cauline leaves narrowly lanceolate, branch leaves and leaves of the innovations very narrowly lanceolate, almost awl-shaped.

Sect. B. HETEROPHYLLAE Card. Mon. Font. 72. 1892.

Leaves dimorphic (cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent), cauline leaves, [both young (vernal) and adult (aestival) leaves of *F. biformis* are included here], firm or flaccid, distant to loosely imbricate, concave or subconcave at base, concave, subconcave, canaliculate, subtubular, or plane above, narrowly or broadly lanceolate, oblong-lanceolate, narrowly or broadly ovate-lanceolate, oval-lanceolate, or suborbicular, gradually acuminate, branch leaves smaller, firm or flaccid, subconcave or concave at base, canaliculate, subcanaliculate, subtubular, tubular, or plane

above, narrowly lanceolate or narrowly oblong-lanceolate, gradually acuminate. The common range of members of this section is the eastern half of the United States.

KEY.

1. Plants with young (vernal) and adult (aestival) forms; young or vernal leaves flaccid, concave, broadly ovate-lanceolate to suborbicular, 4–5 mm. long, 2–3.5 mm. wide; apical cells more or less sphagniform; adult or aestival leaves firm, narrowly lanceolate, canaliculate or subtubular, 2–3.5 mm. long, 0.50–0.75 mm. wide; apical cells more or less sphagniform ..... 6. *biformis.*
   Plants not showing distinct changes with age or seasons; cauline leaves narrowly lanceolate to broadly lanceolate or oblong-lanceolate, 3–8 mm. long, 0.5–2 mm. wide; apical cells not sphagniform ..... 2.
2. Stems more or less flaccid; leaves rather indistinctly dimorphic, cauline slightly concave at base, plane above, narrowly or broadly lanceolate or oblong-lanceolate, 3.5–6.5 mm. long, 1–2 mm. wide ..... 9. *missourica.*
   Stems more or less rigid; leaves distinctly dimorphic, cauline moderately concave, narrowly lanceolate or narrowly ovate-lanceolate, long and narrowly acuminate, 3–8 mm. long, about 0.5–2 mm. wide ..... 3.
3. Cauline leaves more or less firm, narrowly lanceolate, 4–5.5 mm. long, about 1 mm. wide, usually about 1–1.5 times the length of the branch leaves ..... 7. *disticha.*
   Cauline leaves flaccid, narrowly lanceolate to narrowly ovate-lanceolate, 3–8 mm. long, 0.5–2 mm. wide, usually 1.5–3.5 times the length of the branch leaves ..... 4.
4. Cauline leaves narrowly lanceolate to narrowly ovate-lanceolate, 3–8 mm. long, 1–2 mm. wide; branch leaves 2–4 mm. long, 0.45–0.65 mm. wide; upper perichaetial leaves broadly oval ..... 8. *Sullivanti.*
   Cauline leaves narrowly lanceolate, 4–7 mm. long, 0.50–0.85 mm. wide; branch leaves 2–3 mm. long, 0.25–0.35 mm. wide; upper perichaetial leaves broadly oval-oblong, slightly narrowed at apex ..... 8a. *Sullivanti*, var. *microdonta.*

6. FONTINALIS BIFORMIS Sull. Mosses U. S. 54. 1856 (in part, according to Lesquereux & James).

Fontinalis disticha, var., Sull. Musc. Allegh. No. 191. 1845.
Fontinalis disticha, var., Sull. Musc. Allegh. No. 192. 1845.
Pilotrichum sphagnifolium C. Müll. Syn. **2**: 150. 1850.
Pilotrichum distichum C. Müll. Syn. **2**: 150. 1850 (in part, according to Cardot).

Plants moderately slender, *with two forms, appearance varying with age (sometimes considered as changing with seasons)*, young (vernal) forms yellowish-green, adult (aestival) forms dull green; stems rather flaccid when young, commonly more or less rigid when older, 15–30 cm. long, almost entirely denuded with age, pinnately divided; branches numerous, often fasciculate, elongate, erect-spreading; *leaves dimorphic; on young stems (vernal leaves)* more or less distant to loosely imbricate, *large, soft, concave, usually broadly ovate-lanceolate*, some oval-lanceolate to suborbicular, short- to rather long-acuminate, 4–5 mm. long, 2–2.5 mm. wide, occasionally up to 3.5 mm., 1–2.5: 1, more or less early disappearing and giving place to adult (aestival) leaves; *apices usually obtuse*, sometimes subacute or acute, entire to denticulate; median leaf cells linear, obtuse or subobtuse, 11.5–17 μ wide, 3–6 : 1, sometimes up to 10 : 1; *apical cells broadly rhomboidal, hexagonal-rhombic, more or less sphagniform;* alar cells slightly enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, commonly forming small, more or less decurrent auricles; *adult leaves (aestival) very different from first leaves*, appearing after the disappearance of the majority of the first leaves, rather close, imbricate at ends of branches, firm, erect-spreading, *narrowly lanceolate, margins strongly involute to more or less convolute, canaliculate or subtubular, long acuminate*, 2–3.5 mm. long, 0.50–0.75 mm. wide, 3–4.5 : 1; apices acute, entire to denticulate; median leaf cells linear, obtuse or subobtuse, 6.5–12 μ wide, 5–10 : 1, some up to 15 : 1; *apical cells rhomboidal, hexagonal-rhombic, more or less sphagniform;* alar cells slightly enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, commonly forming small more or less decurrent auricles; perichaetium oblong; *upper perichaetial leaves suborbicular*, truncate and lacerate with age; calyptra long-conical, lacerate at base; capsule immersed to one-half emergent, oval-

oblong or subcylindric, 2 mm. long, 0.75 mm. in diameter; operculum conic-rostrate, 1.25–1.50 mm. long; peristome orange-brownish, teeth long-acuminate to subulate, about 0.75 mm. in length, slightly papillose, sometimes slightly united in pairs at the apex, with 18–20 lamellae; inner peristome imperfect, transverse strands very rudimentary, united only at apex, cilia muricate; spores finely muricate, 10–20 μ in diameter.

Type locality, near Columbus, Ohio; collected by Sullivant.

Illustrations:—Sull. Icon. Musc. *pls. 59 & 60;* Engler & Prantl (Ed. 2) **11:** *fig. 475; Pl. 75.*

Exsiccati:—*Sull. & Lesq.* Musci Bor. Am. (Ed. 1) 226b (*f. vernalis*) and 226c (*f. aestivalis*), Ohio; (Ed. 2) 337 (*f. vernalis*) and 338 (*f. aestivalis*), Ohio; *Austin,* Musc. Appal. 245, Ohio; *Sullivant,* Musc. Allegh. 191 (*f. vernalis*) and 192 (*f. aestivalis*), Ohio; *Lucy Allen,* Musci Indianae 12.

In woodland streams, central Ohio and Indiana. Cardot reports that he has seen a specimen which was collected in Wisconsin. In Mosses of Vermont, pp. 36 and 37, March 15, 1898, Grout states that Cardot has written him that he does not know *Fontinalis biformis* from the eastern states.

Fontinalis biformis is distinguished from other Heterophyllae by having its dimorphism shown in young (vernal) leaves and in adult (aestival) leaves rather than in cauline and branch leaves. The sphagniform apical cells aid in quickly recognizing this species when both kinds of leaves are not evident on the same plant; they also help in separating the young leaves of *biformis* from the leaves of *Novae-Angliae.*

7. Fontinalis disticha Hook. & Wils. in Drumm. Musc. Am. S. States. 151. 1841.

Pilotrichum distichum C. Müll. Syn. **2:** 150, 1850, in part, according to Cardot.

Plants slender, more or less delicate, yellowish-green or dull green; *stems more or less rigid,* up to 15 or 20 cm. in length, blackish or reddish, denuded at base; branches pinnate, distant, more or less distichous, erect-spreading to spreading; *leaves dimorphic, distant,* cauline 1–1.5 mm. apart, occasionally up to 1.5 mm., erect-spreading, more or less imbricate at ends of stems and branches, *more or less firm,* moderately concave, *narrowly lanceolate, very long and narrowly acuminate,* acumen sometimes slightly twisted, 4–5.5 mm. long, about 1 mm. wide, approximately 4–5.5 : 1, *usually about 1–1.5 times the length of the branch leaves;* apices acute to subobtuse, denticulate to almost entire; *branch leaves firm, canaliculate or subtubular,* with margins frequently narrowly involute, *narrowly lanceolate, long acuminate,* acumen sometimes slightly twisted, 3–4 mm. long, about 0.50 mm. wide, approximately 6.8 : 1; apices usually denticulate or subdenticulate, sometimes entire; median leaf cells linear-attenuate, 6.5–10.5 μ wide, 10–16 : 1, sometimes up to 20 : 1; alar cells moderately enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, sometimes subhexagonal, *forming slight auricles or none.* According to Sullivant and Lesquereux and James, perichaetium cylindrical; perichaetial leaves truncate and lacerate at apex; capsule narrowly cylindrical and immersed; operculum conical; teeth of peristome papillose, with 12–16 lamellae; inner peristome imperfect, transverse strands of the lower half incomplete and appendiculate.

Type locality, New Orleans, Louisiana; collected by Thomas Drummond.

Illustrations:—Sull., Icones Musc. *pl. 63; Pl. 75.*

Exsiccati:—*Drumm.* Musc. Am. S. States, 151; *Sull.* Musc. Allegh. 190; *Sull. & Lesq.* Musc. Bor. Am. (Ed. 1) 227, Ala. (Ed. 2) 399 in part; *Baker,* Alabama Biological Survey, 41, May 26, 1897.

In streams, in Louisiana and Alabama. N. Carolina (Wetherby); Michigan (Ehlers)

Fontinalis disticha is characterized by plants slender and rather delicate, stems more or less rigid, leaves distinctly dimorphic, distant, cauline 1–1.5 mm. apart, some up to 1.5 mm., more or less firm, narrowly lanceolate, very long and narrowly acuminate, approximately 1–1.5 times the length of the branch leaves, alar cells moderately enlarged, forming slight auricles or none.

8. Fontinalis Sullivanti Lindb. Oefv. Finska Vet.-Soc. Förh. **12:** 78. 1869.

Fontinalis Lescurii Sull., var. *gracilescens* Sull. Icones Musc. 101. 1864.
Fontinalis Renauldi Card. Rev. Bryol. **18:** 82 and 85. 1891.

Plants very slender, delicate, yellowish or yellowish-green; *stems more or less rigid,* up to 15 or 20 cm. in length, reddish, denuded at base, pinnately divided; branches distant, distichous, widely spreading; *leaves dimorphic, very distant,* cauline 1–2 mm. apart, more or less imbricate at ends of stems and branches, erect-spreading, *flaccid, more or less concave, narrowly ovate-lanceolate to narrowly lanceolate, long and narrowly acuminate,* 3–8 mm. long, 1–2 mm. wide, 3–7 : 1, *usually 1.5–3 times the length of the branch leaves;* apices acute or subobtuse, commonly denticulate, occasionally subdenticulate, rarely entire; *branch leaves flaccid to more or less firm, concave, canaliculate, narrowly lanceolate,* acuminate, 2–4 mm. long, 0.45–0.65 mm. wide, 2.5–7 : 1; apices acute to subobtuse, subdenticulate or denticulate; median leaf cells linear attenuate, 6.5–

12 μ wide, 8–15 : 1; alar cells enlarged, yellowish, subhyaline, or hyaline, rectangular or oblong to quadrate, sometimes subhexagonal, *usually forming distinct auricles;* perichaetium narrowly cylindrical; *upper perichaetial leaves broadly oval,* rounded, truncate and lacerate with age; capsule immersed or very slightly emergent, narrowly cylindrical, 2.5–3 mm. long, 0.50–0.65 mm. in diameter; operculum conical and long acuminate; peristome orange-brownish, teeth narrowly lanceolate, acuminate, slightly papillose, 0.50–0.65 mm. long, with 15–23 lamellae; inner peristome imperfect, muricate, transverse strands of lower half incomplete; spores very finely muricate, 18.5–20.5 μ in diameter.

Type locality, Closter, New Jersey; collected by Austin.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—*Austin,* Musc. Appal. 249, N. J., assumed to be duplicate type, in Grout Herb., Herb. of Yale University, and in National Museum of Canada; *Aust.* Musc. Appal. Suppl. I, 524, N. J. & Pa.; *Sull. & Lesq.* Musc. Bor. Am. (Ed. 2) 341; *Huntington,* Grout, N. Am. Musc. Pl. 73, Mass.; *Nichols,* C_5, Conn.; *Latham,* 54, N. Y.; *Hood,* Grout, N. Am. Musc. Pl. 407, Fla.; *Andrews,* Nov., 1931, Ala.

In stagnant water, attached to bushes, stumps, and roots of trees, in New Jersey, Pennsylvania, Massachusetts, Connecticut, Florida and Alabama. Lesquereux and James cite New Hampshire and Vermont. Cardot states that it has been reported also as occurring in Delaware and Rhode Island. According to Cardot, the *F. Sullivanti* reported from Brattleboro, Vermont, is the *F. Lescurii,* var. *ramosior* of Sullivant instead of the *F. Sullivanti* of Lindberg. According to specimens examined *F. Sullivanti* is collected more frequently in northeastern United States than elsewhere. I have seen two different collections from Florida but both were from the same location.

Fontinalis Sullivanti may be distinguished from *F. disticha* by plants very slender and delicate, cauline leaves very distant, 1–2 mm. apart, flaccid, approximately 1.5–3 times the length of the branch leaves, alar cells enlarged, commonly forming distinct auricles.

Fontinalis Sullivanti forma *viridis* followed by "foliis mollioribus" occurs on a packet of material determined by Cardot. An attempt to locate a description of this form has been unsuccessful. Since the leaves of *F. Sullivanti* are flaccid, I consider these plants as belonging to the species.

8a. Var. MICRODONTA (Ren.) **n. comb.**

Fontinalis Sullivantii Card. Rev. Bryol. **18**: 83 and 85. 1891, not of Lindberg.
Fontinalis microdonta Ren. in litt., according to Cardot.

Some plants flaccid, others more or less rigid, branches very distant, erect or erect-spreading; cauline leaves about 1 mm. apart, erect-spreading, *concave or subconcave at base, plane above, narrowly lanceolate, very long and narrowly acuminate,* 4–7 mm. long, 0.50–0.85 mm. wide, 6.5–10 : 1, apices acute or subacute; *branch leaves flaccid to more or less firm, very concave, very long and narrowly acuminate, subcanaliculate or tubular,* 2–3 mm. long, 0.25–0.35 mm. wide, 5–12 : 1; apices acute, or subacute, occasionally entire; median leaf cells up to 22 : 1; perichaetium cylindric; *perichaetial leaves broadly oval-oblong, slightly narrowed at apex,* sometimes slightly plicate above; capsule narrowly cylindrical, 2–2.25 mm. long, 0.50 mm. in diameter; operculum conical; peristome sometimes yellowish, teeth narrowly linear-acuminate, about 0.50 mm. long, sometimes united in pairs at the apex; inner peristome very rudimentary, transverse strands incomplete, cilia muricate, appendiculate; spores sometimes almost smooth.

Type locality, unknown; North America.

ILLUSTRATIONS:—*Pl. 74.*

EXSICCATI:—Without collector, date, locality, or number, herb. Lab. de Cryptogamie, Muséum d' Histoire Naturelle, Paris; *Lesquereux,* 1883, North America, from Herb. Renauld in Farlow Herbarium.

Cardot places *F. microdonta* in the Malacophyllae. Since the leaves are distinctly dimorphic and resemble so closely those of *F. Sullivanti* Lindb., I am including it in Heterophyllae. Two collections, one sterile and one fruiting, have been available for study. It is quite probable that both are from the same collection. *F. microdonta* and *F. Sullivanti* Lindb. compare so closely in all parts except leaf width and capsule size that there is a strong possibility that the specimen named *microdonta* is a dwarfish form of *Sullivanti* Lindb. However, with very little available material for the determination of constant distinguishing characteristics, it is impossible to make an accurate decision. The cauline and branch leaves of *microdonta* are narrower than those of *Sullivanti* Lindb.; the perichaetial leaves of *microdonta* are broadly oval-oblong and slightly narrowed at apex, while those of *Sullivanti* Lindb. are broadly oval; and the capsule of *microdonta* is smaller, 2–2.25 mm. long and 0.50 mm. in diameter in contrast with a length of 2.5–3 mm. and a diameter of 0.50–0.65 mm. in *Sullivanti* Lindb.

9. FONTINALIS MISSOURICA Card. Rev. Bryol. **23**: 69. 1896.

Fontinalis Holzingeri Card. Minn. Bot. Studies **1898, no. VI**: 43 and 3^2: 129. *pl. 21.* 1903.
Fontinalis Umbachi Card. Minn. Bot. Studies 3^2: 129. *Pl. 22.* 1903.

Plants slender, green to yellowish-green, sometimes brownish below; *stems more or less flaccid*, yellowish- or reddish-brown, up to 15–20 cm. in length, more or less denuded at base; branches pinnate, spreading or erect-spreading; *leaves rather indistinctly dimorphic*, distant, subimbricate to loosely imbricate at ends of stems and branches; *cauline leaves more or less flaccid, concave to slightly concave at base and plane above*, occasionally margins narrowly involute, *narrowly or broadly lanceolate, or oblong-lanceolate*, some gradually longly and narrowly acuminate, others gradually shortly and broadly acuminate, 3.5–6 mm. long, few up to 6.5 mm. in length, 1–2 mm. broad, 2.5–6 : 1; apices acute to subobtuse, entire to denticulate; *branch leaves more or less flaccid, usually concave at base, plane at apex or subcanaliculate*, with some margins narrowly involute, *narrowly lanceolate or narrowly oblong-lanceolate*, gradually short-or long-acuminate, 2.50–4 mm. long, 0.5–0.8 mm. wide, 3–6 : 1; apices acute or subobtuse, entire to denticulate; median leaf cells linear-attenuate, 6.5–13.5 μ wide, 8–17 : 1; alar cells moderately enlarged, hyaline to yellowish, or yellowish-brown, rectangular, quadrate, or subhexagonal, frequently forming slight auricles; fruit unknown.

Type locality, near Cole Camp Creek, Benton County, Missouri; collected by the Rev. C. H. Demetrio, July 12, 1894.

ILLUSTRATIONS:—Card. l. c.; *Pl. 75*.

EXSICCATI:—*Demetrio*, 172, Mo., assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in Farlow Herbarium; 5191 in E. B. Chamberlain Herb., May 29, 1896, Mo.; 3810 in E. B. Chamberlain Herb., Sept. 23, 1907, Mo.; *Holzinger & Elftman*, Mosses of Northern Minnesota International Boundary Trip of 1897, Second Falls of Granite River; *Umbach*, Des Plaines R., Romeo, Ill., June, 1898; 1104, Romeo, Ill.; *Grout*, N. Am. Musc. Pl. 279, Romeo, Ill.; *Morrison & Dawson*, April 15, 1933, Ind.; *Welch*, 1084 Ind.; *Bush*, Plants of Ark. 5414, 5414A; collector unknown, August, 1903, Magnolia, Mass.

In springs, streams, and rivers; collections from Minnesota, Missouri, Illinois, Indiana, Arkansas, and Massachusetts examined.

Fontinalis missourica Card. is characterized by plants slender, stems flaccid or nearly so, leaves rather indistinctly dimorphic, more or less flaccid, cauline leaves slightly concave at base and plane above, broadly lanceolate, oblong-lanceolate, or linear-lanceolate, gradually acuminate, some apices short and broad, others long and narrow, branch leaves smaller, concave at base, subcanaliculate or plane above, narrowly lanceolate or narrowly oblong-lanceolate, gradually short- or long-acuminate.

I have examined the types or duplicate types of *F. missourica*, *F. Holzingeri*, and *F. Umbachi*, but only sterile specimens have been available. With the exception of "younger perichaetial leaves orbicular-ovate, apiculate, apex slightly denticulate" in *F. Holzingeri*, no information concerning the fruits of these plants has been found. With some hesitation, I have placed *F. Holzingeri* and *F. Umbachi* in the synonymy of *F. missourica*, because I have been unable to find any constant, vegetative characteristics by which these three plants may be separated. The study of the fruits will aid in a more satisfactory decision.

I have examined *Fontinalis Nelsoni* Card. sp. nova, Missouri Mosses 1020, collected by N. L. T. Nelson, Irondale, Nov. 5, 1905. I consider the material as belonging to *F. missourica*. Search for the original description has been unsuccessful.

Sect. C. LEPIDOPHYLLAE Card. Mon. Font. 80. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), or exceptionally dimorphic (cauline leaves and branch leaves unlike with intergradations in shape or size more or less absent), firm or nearly so, exceptionally flaccid, more or less concave, ovate-lanceolate, oblong-lanceolate, oval-lanceolate, narrowly lanceolate, sublinear, or rarely broadly ovate. The common range of the members of this section is eastern United States and Canada, although a few have been collected in Ohio, Wisconsin, Missouri, and Saskatchewan.

KEY.

1. Leaves dimorphic, firm or slightly flaccid; older cauline leaves ovate-lanceolate or oblong-lanceolate, usually narrowed into an elongated acumen, 4.5–6 mm. long, 1–2 mm. wide, younger cauline and branch leaves ovate-lanceolate, 3–4.5 mm. long, 1.5–2 mm. wide; apices short, broad, and obtuse ..... *11f. Novae-Angliae*, var. *heterophylla*.

   Leaves uniform, older cauline leaves and younger cauline and branch leaves similar with intergradations in shape or size present ..... 2.

2. Leaves large, ovate-lanceolate, oval-lanceolate, or oblong-lanceolate, 4–7.5 mm. long, 1.5–3 mm. wide, 2–3 : 1 ..... 3.

Leaves smaller, oblong-lanceolate or ovate-lanceolate to sublinear, 2–6 mm. long, 0.50–2.5 mm. wide, 1.75–4 : 1 ..... 4.

3. Apices frequently subcarinate or carinate; leaves more or less firm, ovate-lanceolate, oval-lanceolate, or oblong-lanceolate, 5–5.5 mm. long, about 2 mm. wide, approximately 2.5 : 1 ..... *12. Allenii.*

Apices concave; leaves flaccid, more or less broadly ovate-lanceolate, 4–7.5 mm. long, 1.5–3 mm. wide, 2–3 : 1 ..... *11e. Novae-Angliae*, var. *latifolia.*

4. Leaves narrowly lanceolate or oblong-lanceolate, 2–4 mm. long, 0.5–1.25 mm. wide, 3–3.5 : 1; apices usually more or less acute; plants slender.. 5.

Leaves slightly distant, oblong-lanceolate, ovate-lanceolate, or sublinear, 3–7.5 mm. long, 0.5–3 mm. wide, 1.75–4 : 1; apices usually more or less obtuse, some subacute, sometimes more or less cucullate; plants slender to moderately robust ..... 6.

5. Upper perichaetial leaves usually narrowed at apex, acute, or apiculate. ... *10. dalecarlica.*

Upper perichaetial leaves rounded-obtuse ..... *10a. dalecarlica*, var. *Macounii.*

6. Leaves oblong-lanceolate or ovate-lanceolate, majority of margins of apices narrowly involute, 3–6 mm. long, 0.75–2.5 mm. wide, 2–4 : 1; apices denticulate to entire, some cucullate ..... 7.

Leaves sublinear or oblong-lanceolate, majority of margins of apices broadly involute, 3–5 mm. long, 0.50–1.75 mm. wide, approximately 2.5 : 1; apices denticulate, frequently cucullate ..... *11b. Novae-Angliae*, var. *involuta.*

7. Leaves approximately 3 mm. long, 1–1.25 mm. wide, 2.5–3 : 1, closely appressed-imbricate; apices denticulate; branches very slender. ... *11a. Novae-Angliae*, var. *Lorenziae.*

Leaves 2.5–6 mm. long, 0.75–2.5 mm. wide, 1.75–4 : 1, slightly distant to imbricate; apices entire or denticulate; branches more or less robust. . 8.

8. Stems rather flaccid to more or less rigid; branches more or less distant, occasionally fasciculate; leaves more or less firm; apices occasionally cucullate ..... 9.

Stems very flaccid; branches fasciculate; leaves more or less flaccid; apices rarely cucullate ..... *11g. Novae-Angliae*, var. *Grouti.*

9. Leaves usually ovate-lanceolate, 2.5–6 mm. long, 1–2.5 mm. wide, 1.75–4 : 1; apices usually denticulate, some more or less cucullate; upper perichaetial leaves with apices rounded or subapiculate.. ..... *11. Novae-Angliae.*

Leaves usually oblong-lanceolate, 3–5 mm. long, 0.75–2 mm. wide, 2–4 : 1; apices commonly entire, frequently denticulate; upper perichaetial leaves with apices rounded-obtuse.. ..... 10.

10. Apices usually more or less narrowly obtuse; capsule immersed. ... *11c. Novae-Angliae*, var. *Delamarei.*

Apices usually more or less broadly rounded-obtuse; capsule approximately one-half emergent ..... *11d. Novae-Angliae*, var. *Waghornei*

10. Fontinalis dalecarlica Bryol. Eur. 5: *pl. 431.* 1846.

Fontinalis squamosa L. Herb., according to Cardot.
Fontinalis squamosa β. dalecarlica Hartm. Handb. Skand. Fl. 341. 1849.
Pilotrichum dalecarlicum C. Müll. Syn. 2: 149. 1850.
Fontinalis squamosa, var. *dalecarlica* Husnot, Musc. Gall. 287. 1892.

Plants slender, dull, sometimes glossy at tips of stems and branches, olive-green to dark green or yellowish; stems 10–50 cm. long, more or less rigid, blackish, *denuded at base; branches numerous, fasciculate, close, slender, elongate*, attenuate; leaves more or less imbricate, erect or erect-spreading, *narrowly lanceolate* or narrowly oblong-lanceolate, *more or less long-acuminate, concave*, margins usually involute, 2–4 mm. long, 0.5–1.25 mm. wide, 3–3.5 : 1; apices narrowly obtuse or acute, denticulate to entire; median leaf cells linear-attenuate, 6.5–15 μ wide, 10–15 : 1, sometimes up to 20–25 : 1; alar cells enlarged, yellowish or subhyaline, quadrate, rectangular, or subhexagonal, sometimes forming definite auricles; perichaetium oval or oblong; *upper perichaetial leaves commonly narrowed at apex, acute or apiculate*, lacerate with age; capsule immersed,

oval, oblong, or subcylindric, 2 mm. long, 0.5–1 mm. in diameter; operculum short-conical, obtuse, 0.45–1 mm. long; peristome orange-brownish, sometimes yellow-brownish, teeth linear-acuminate, more or less granulose, 0.3–0.75 mm. long, with 12–22 lamellae; trellis imperfect, very slightly muricate, transverse strands of the lower half incomplete, not appendiculate; spores slightly muricate, majority ranging from 25–35 μ in diameter, mature in summer.

Type locality, Sweden.

Illustrations:—Bryol. Eur. *pl. 431;* Husnot, Musc. Gall. *pl. 80;* H. J. Möller, Arkiv för Botanik 17: No. 14, *figs. 19–21;* Jennings, Mosses W. Pa. *pl. 30;* Grout, M.H.M. *pl. 88* and *fig. 218; Pl. 76.*

Exsiccati:—*Drumm.*, Musc. Am. 233; *Sull.*, Musc. Allegh. 189; *Aust.*, Musc. Appal. 251; *Sull. & Lesq.*, Musc. Bor. Am. (Ed. 1) 229; (Ed. 2) 342; *Grout*, Musci Perfecti 22, Vt.; *Grout*, N. Am. Musc. Pl. 286, Vt. and 286a, Wis.; *E. D. Merrill*, Flora of Maine, 67; *G. K. Merrill*, 186, Me.; *Dutton*, Vermont Flora, 404; *Welch*, 713, Vt.; *G. E. Nichols*, Conn., in 1907; *Anne Murray Vail*, N. Y., Aug. 1892; *Chapman*, 2064, Va.; *J. K. Small*, W. Va., June 17, 1892; Mosses of Southern United States, 32, Ga.; *Sharp*, 33,133, Tenn.; *Deam*, Flora of Indiana, 29527; *Low*, Canadian Cryptogams, 53, Labrador; *Macoun*, Canadian Musci, 600, N. S.; *Prince*, Nova Scotia Flora, 6187.

In streams, Labrador to Georgia, west to Ontario, Tennessee, Indiana, and Wisconsin; Greenland, according to Kindberg. Europe.

Fontinalis dalecarlica is easily recognized by its slender habit, the small, concave, lanceolate, more or less long-acuminate leaves, usually with involute margins, and perichaetial leaves usually narrowed at apex, acute, or apiculate.

I have seen no North American specimen which I believe to be *Fontinalis squamosa* L.

Cardot, in Mon. Font. 88, states that he has found in Canadian Musci 231, mixed with *F. Lescurii*, a form analogous to *F. dalecarlica*, var. *gracilescens* Warnst., which he reports as occurring in western Prussia. I have carefully examined Canadian Musci 231, in the Herbarium of Yale University, and I find no plants which satisfy Cardot's description of var. *gracilescens*. Limpricht, in Die Laubmoose, vol. 2, p. 671, considers *F. dalecarlica*, var. *gracilescens* Warnst. as a synonym of *F. microphylla* Schimp. I have found no report of the occurrence of *F. microphylla* in North America.

10a. Var. *Macounii* Card. Rev. Bryol. 20: 9. 1893, and 23: 70. 1896.

Plants similar to *dalecarlica; upper perichaetial leaves round-obtuse.*

Type locality, Lake Athabasca, Canada; collected by Macoun, 1875.

Exsiccati:—*Macoun*, Flora Canadensis, 755, Lake Athabasca, Sept. 24, 1872; Lake Athabasca, 1879.

I have studied the collections from Lake Athabasca only. The plants of var. *Macounii* examined are more or less flaccid. Cardot separates the variety from *dalecarlica* upon the basis of the round-obtuse perichaetial leaves (acute or apiculate in the species). There were two capsules in the material sent to me by Allorge from the herbarium of the Laboratoire de Cryptogamie, Muséum d'Histoire Naturelle, Paris. I was unable to determine characteristics of perichaetial leaves because they were too old and lacerated. For that reason I have retained Cardot's varietal difference. If, upon examination of a large number of fruits, the upper perichaetial leaves are not consistently round-obtuse but are also acute or apiculate, I should consider *F. dalecarlica*, var. *Macounii* a synonym of *F. dalecarlica.*

11. Fontinalis Novae-Angliae Sull. Mosses U. S. 104. 1856.

Fontinalis Howei Aust. ms. in herb., according to Cardot.
Fontinalis Cardoti Ren. in litt., according to Cardot.

Plants slender to slightly robust, dull or glossy, green, to yellowish-green, sometimes more or less brownish; stems rather flaccid to more or less rigid, 15–40 cm. in length, denuded at base, pinnately divided; branches more or less distant, sometimes fasciculate; *leaves* erect or erect-spreading, slightly distant, subimbricate or imbricate, more or less firm, concave to very concave, *usually more or less broadly ovate-lanceolate although frequently oblong-lanceolate, margins more or less narrowly involute*, 2.5–4 mm. long, sometimes up to 6 mm. in length, 1–2 mm. wide, sometimes 2.5 mm. in width, 1.75–4 : 1; *apices more or less broadly obtuse*, subobtuse, or apiculate, *usually denticulate*, rarely entire, some more or less cucullate; median leaf cells linear-attenuate or linear-rhomboidal, 6.5–12 μ wide, usually 8–15 : 1, rarely up to 20 : 1; alar cells enlarged, subhyaline, yellowish, or brownish, rectangular, quadrate, or subhexagonal, frequently forming distinct auricles; perichaetium oblong or subcylindric; *upper perichaetial leaves oval to suborbicular*, apices rounded or subapiculate, more or less truncate and lacerate with age; capsule immersed, more or less cylindrical, 2–2.5 mm. long, sometimes 3 mm. in length, 0.5–1 mm. in diameter; operculum conical to conic-acuminate, 0.75–1 mm. long; peristome orange-brownish, teeth linear-acuminate, more or less papillose, 0.50–0.65 mm. long, 13–20 lamellae; trellis imperfect, cilia generally united at apex only, more or less muri-

cate, transverse strands smooth to very slightly muricate, usually incomplete; spores smooth to very finely muricate, 20–22 μ in diameter, mature in summer.

Type locality, New England.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 65;* Jennings, Mosses W. Pa. *pl. 30;* Grout, M.H.M. *fig. 217* and *pl. 88b; Pl. 76.*

EXSICCATI:—*Austin*, Musc. Appal. 244, 246, N. J., 247, 248 in part, N. J.; *Sull. & Lesq.* Musc. Bor. Am. (Ed. 1) 225, (Ed. 2) 336; Grout, N. Am. Musc. Pl. 272, Mass. and 428 (as *F. Lescurii*) N. Y. City; *Welch*, 712, Vt.; *Pringle*, Vt., June 18, 1880; *E. D. Merrill*, Flora of Maine, 70; *Huntington*, Mass., Feb. 20, 1903; *Nichols*, Conn. Mosses, C_3a; *Graves*, Conn. Flora, 466; *Sharp*, 34103, Tenn.; Bryophytes of Oklahoma 12; *Small*, 26, Ga.; *Macoun*, Canadian Musci, sheet 3960 in National Museum of Canada, N. S.; *Dupret*, Mousses du Canada, 118, 123, Quebec.

In streams, Nova Scotia to Georgia, westward to Quebec, Tennessee, and Oklahoma. Jennings reports it also in Newfoundland and Ontario.

Fontinalis Novae-Angliae may be distinguished by leaves concave, usually ovate-lanceolate although frequently oblong-lanceolate, margins more or less narrowly involute, apices commonly more or less broadly obtuse, subobtuse, or apiculate, some more or less cucullate, usually denticulate, and upper perichaetial leaves oval to suborbicular, apices rounded or subapiculate.

I have examined two sterile specimens determined by Cardot as *F. Cardoti*, one collected by Pringle, June 18, 1880, Enosburgh, Vt., and the other collected by Small, July, 1893, Little Stone Mt., Ga., Mosses of Southern United States 26. Upon examination of this material and study of Cardot's description, it seems to me that the variations between *Novae-Angliae* and *Cardoti* are sufficiently slight to place *Cardoti* in the synonymy of *Novae-Angliae.*

11a. Var. LORENZIAE Card. Rhodora **15**: 9. 1913.

Branches very slender, elongated, leaves closely appressed-imbricate, more or less firm, concave, ovate-lanceolate or oblong-lanceolate, *small*, approximately 3 mm. long, some up to 4 mm. in length, 1–1.25 mm. wide, 2.5–3 : 1; margins frequently narrowly involute; apices usually round-obtuse, some acute, *denticulate;* fruits unknown.

Type locality, Andover, Conn.; collected by C. A. Weatherby.

ILLUSTRATIONS:—*Pl. 76.*

EXSICCATI:—*Weatherby*, Andover, Conn., 1907, cotype or duplicate type, in Herbarium of Yale University; *Sharp*, 88,126, Tenn.; Bryophytes of Highlands, N. C. 107.

This variety has been reported from Connecticut, Tennessee, and North Carolina.

Var. *Lorenziae* is characterized by habit more or less like that of *dalecarlica* and leaves very similar in shape to those of *Novae Angliae* but smaller. I have retained this plant as a variety of *Novae Angliae* although it has several characteristics in common with *dalecarlica*, because I have been unable to obtain fruiting material, which would aid in making a more satisfactory decision.

11b. Var. *cymbifolia* (*Aust.*) **n. comb.**

Fontinalis Lescurii Sull., var. ? *cymbifolia* Aust. Musc. Appal. 248. 1870.
Fontinalis involuta Ren. & Card., Card. Rev. Bryol. **18**: 83 & 86. 1891.

Branches frequently compressed; *leaves* more or less close, subimbricate to imbricate, firm, erect-spreading, *sublinear or oblong-lanceolate, concave to very concave, more or less canaliculate, usually margins strongly and more or less broadly involute*, 3–5 mm. long, 0.50–1.75 mm. wide, approximately 2.5 : 1; apices short, more or less broad, obtuse or subacute, denticulate, frequently cucullate; median leaf cells 6.5–12 μ wide, 7–16 : 1; alar cells rectangular, quadrate, or subhexagonal, brown, yellowish, or hyaline, sometimes forming distinct auricles; according to Cardot, capsule immersed.

Type locality, New Orleans, Louisiana; collected by Drummond.

ILLUSTRATIONS:—*Pl. 76.*

EXSICCATI:—*Austin*, Musc. Appal. 248, N. J.; *Drumm.* Musc. Am., S. States, 152; *Langlois*, Ren. & Card., Musc. Am. Sept. 186, La.; *Langlois*, Grout, N. Am. Musc. Pl. 388, La.; *Grout*, N. Am. Musc. Pl. 348, Vt.; Vt., Aug. 1, 1900; *Welch, 1086*, Ky.; *Sharp*, 124, Tenn.

In ponds and streams, Vermont and New York to Louisiana and Florida, west to Kentucky and Tennessee.

I consider *involuta* to be a variety of *Novae Angliae* because of the similarity in the leaf characteristics. I have seen no fruits of *involuta* and Cardot's description of them is very incomplete, but I assume that they are similar to those of *Novae Angliae.*

11c. Var. DELAMAREI (Ren. & Card.) **n. comb.**

Fontinalis Delamarei Ren. & Card. Rev. Bryol. **15**: 71. 1888.
Fontinalis squamosa Delamare, Ren. & Card., Florule de l'île Miquelon 49, 1892.

Plants dull or glossy, olive-green to brownish; *branches* pinnate and *more or less close*, often fasciculate; *leaves* erect or erect-spreading, *more or less close, usually subimbricate to imbricate*, concave, *commonly oblong-lanceolate*, sometimes ovate-lanceolate, margins generally narrowly involute, some more or less broadly involute, 3–5 mm. long, 0.75–1.5 or 2 mm. wide, 2.5–4 : 1; *apices usually more or less narrowly obtuse*, sometimes subacute or acute, *commonly subentire or entire although frequently denticulate or subdenticulate;* according to Cardot, perichaetial leaves round-obtuse, lacerate with age; capsule and peristome very similar to those of *Novae-Angliae;* spores slightly muricate, 25–28 μ in diameter.

Type locality, Island of Miquelon; collected by Dr. Delamare.

ILLUSTRATIONS:—Bot. Gaz. **14**, *pl. 14A; Pl. 76.*
EXSICCATI:—*Delamare*, Ren. & Card., Musc. Am. Sept. 72, Miquelon, assumed to be type or duplicate type, in Grout Herbarium, herbarium of Yale University, and in National Museum of Canada.

In streams of Island of Miquelon.

Variety *Delamarei* is distinguished from *Novae-Angliae* by branches more or less close, leaves subimbricate to imbricate, and commonly oblong-lanceolate, usually narrowly obtuse, with majority of apices entire or slightly denticulate.

11d. Var. WAGHORNEI (Card.) **n. comb.**

Fontinalis Waghornei Card. Rev. Bryol. **23**: 71. 1896.

Leaves close, usually *oblong-lanceolate, very concave*, 3–5 mm. long, 0.75–2 mm. wide, 2–4 : 1; margins of apices more or less narrowly involute, *apices usually more or less broadly round-obtuse*, subacute, or acute, *some more or less cucullate, entire to denticulate;* perichaetium oblong to subcylindric; capsule approximately one half emergent, slightly constricted beneath mouth when dry, 2.5–3 mm. long, 0.75–1 mm. in diameter; peristome brownish-orange, teeth frequently united in pairs at apex, densely papillose, approximately 0.75 mm. long, *20–30 lamellae; lattice perfect or almost so*, cilia more or less papillose, transverse strands almost smooth or slightly papillose, not appendiculate, more or less complete to base.

Type locality, Heart's Content, Trinity Bay, Newfoundland; collected by the Rev. A. C. Waghorne, March 30, 1892.

ILLUSTRATIONS:—*Pl. 76.*
EXSICCATI:—*Waghorne*, 42, Nfld., assumed to be type or duplicate type, in herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris; *Waghorne*, Trinity Bay, Newfoundland, 1893, in Herbarium of The New York Botanical Garden.

Without fruit, it is difficult to distinguish between *Novae-Angliae* and var. *Waghornei*. The leaves of *Novae-Angliae* are usually more or less broadly ovate-lanceolate although frequently oblong-lanceolate and the apices are commonly distinctly denticulate; the leaves of *Waghornei* are usually more or less broadly oblong-lanceolate, although some are ovate-lanceolate or oval-lanceolate and the apices are frequently entire. Variety *Delamarei* differs in apices usually more or less narrowly obtuse, commonly sub-entire or entire. Variety *Waghornei* may be separated from var. *involuta* by leaves usually broader, margins more narrowly involute and many apices more or less entire. When in fruit, var. *Waghornei* may be distinguished from other members of Lepidophyllae by capsules approximately one half emergent, lamellae commonly more numerous, and trellis perfect or almost so. I have had only one collection for study and, according to Cardot's exsiccati, this is perhaps the only locality from which this plant has been collected.

11e. Var. LATIFOLIA Card. Rhodora **15**: 9. 1913.

Leaves large, flaccid, more or less broadly ovate-lanceolate, 4–7.5 mm. long, 1.5–3 mm. wide, 2–3 : 1; fruit unknown.

Type locality, Burlington, Conn.; collected by G. E. Nichols, April 16, 1908.

ILLUSTRATIONS:—*Pl. 76.*
EXSICCATI:—*Nichols*, C_9, Conn., cotype or duplicate type, in herbaria of Yale University and The New York Botanical Garden; *Grout*, N. Am. Musc. Pl. 280, Vt.; Vt., Aug. 27, 1903; *Huntington*, Mass., Mar. 5, 1905; *Blagg*, 9–712, New York; *Steyermark*, Plants of Missouri, 83.

The springs, brooks, and pools, Vermont, Massachusetts, Connecticut, New York, and Missouri.

This variety is distinguished from all other members of Lepidophyllae by its large, broadly-ovate, flaccid leaves.

11f. Var. HETEROPHYLLA Card. Rhodora 15: 9. 1913.

Leaves more or less dimorphic, older cauline leaves and younger cauline and branch leaves unlike, with intergradations in shape or size more or less absent, firm or slightly flaccid; *older cauline leaves* slightly concave or almost plane, ovate-lanceolate or oblong-lanceolate, some margins slightly involute toward apex, 4.5–6 mm. long, 1–2 mm. wide, 2.5–5 : 1; *apices gradually narrowed, elongate*, more or less obtuse, some acute, denticulate; *younger cauline and branch leaves* concave, ovate-lanceolate, 3–4.5 mm. long, 1.5–2 mm. wide, approximately 2 : 1; *apices short and broad*, rounded-obtuse, denticulate, some margins slightly involute toward apex; fruit unknown.

Type locality, North Branford, Conn.; collected by G. E. Nichols, June 11, 1911.
ILLUSTRATIONS:—*Pl. 76.*
EXSICCATI:—*Nichols*, C_3b, Conn., type or duplicate type, in the herbaria of Yale University and The New York Botanical Garden.
In a rocky brook, North Branford, Conn.
This variety differs from *Novae-Angliae* in leaves dimorphic, margins very slightly involute or plane, and apices not cucullate or very rarely so, those of the older cauline leaves more or less long and narrow.

11g. Var. GROUTI n. var.

Plantae subgraciles, maxime molles, nitidae, pallide virides aut virides parte superiore, fulvae parte inferiore; caules subtenues, 15–20 cent. longi, subdenudati aut denudati et nigricantes parte, inferiore pinnati aut bipinnati; rami fasciculati, elongati, usque ad 7 cent. longitudine, erecti aut suberecti; folia distantia, usque ad 1.5 mill., subimbricata aut imbricata ad extremum caulium et ramorum, subflaccida aut flaccida, concava aut subconcava et amplexa ad basim, plurima plana supra, alia subconcava aut late inflexa, ovato-lanceolata aut oblongo-lanceolata, 4–5.5 mill. longa, 1.25–2 mill. lata, 2–3 : 1; apices acuti, subacuti, subobtusi, obtusi, aut late-obtusi, raro cucullati, plerumque denticulati, interdum subdenticulati, interdum integri, frequenter subinflexi; cellulae mediae lineares-rhomboidales aut lineares-attenuatae, 6.5–13.5 micromill. latae, 7–15 : 1; cellulae apicales interdum subrhomboidales; cellulae alares magnae, dilatatae, hyalinae, luteolae, aut fulvae oblongae, quadratae, aut subhexagonales, plerumque auriculae bene distinctae; fructus ignotus.

Plants rather slender, very flaccid, glossy, pale green or green above, brownish below; stems slightly delicate, 15–20 cm. long, more or less denuded and blackish at base, pinnately to bipinnately divided; *branches fasciculate, elongate*, up to 7 cm. in length, *erect to erect-spreading;* leaves distant, up to 1.5 mm. apart, subimbricate to imbricate at end of stems and branches, slightly flaccid or flaccid, more or less concave and clasping at base, usually plane above, some slightly concave to broadly involute, *ovate-lanceolate or oblong-lanceolate*, 4–5.5 mm. long, 1.25–2 mm. wide, 2–3 : 1; *apices acute or subacute to rounded-obtuse, very rarely cucullate, usually denticulate*, sometimes subdenticulate, occasionally entire, *frequently narrowly involute;* median leaf cells linear-rhomboidal or linear-attenuate, 6.5–13.5 μ wide, 7–15 : 1; apical cells occasionally more or less rhomboidal; alar cells enlarged, hyaline, yellowish, or brownish, rectangular, quadrate, or subhexagonal, commonly forming distinct auricles; fruit unknown.

Type locality, Fish Pond, New York Fish Hatchery, Cold Spring Harbor, Long Island, New York; collected by A. J. Grout.

EXSICCATI:—Type, in Grout Herbarium; fragment of type in author's herbarium.
F. Novae-Angliae, var. *Grouti* differs from the species in plants very flaccid, branches fasciculate, and leaves more or less flaccid, usually more distant, less concave, and apices rarely cucullate.

12. FONTINALIS ALLENII Card. Rhodora 15: 8. 1913. Emend.

Plants more or less robust, glossy, yellowish, golden-yellow, or copper-yellow; stems 15–20 cm. long, more or less rigid, reddish, denuded at base, pinnately divided; branches erect or erect-spreading; *leaves firm*, erect or appressed, subimbricate to imbricate, *ovate-lanceolate, oval-lanceolate, or oblong-lanceolate*, more or less concave, *short and broadly acuminate*, 5–5.5 mm. long, about 2 mm. wide, approximately 2.5 : 1; *apices short and broad, plane, concave, subcarinate, or carinate, rounded-obtuse*, rarely subobtuse or acute, entire to denticulate; median leaf cells linear-attenuate, 6.5–17 μ wide, 10–20 : 1; alar cells usually much enlarged, hyaline to yellowish, quadrate, rectangular, or subhexagonal, commonly forming definite auricles; fruit unknown.

Type locality, Mt. Carmel, Hamden, Connecticut; collected by J. A. Allen, Oct. 22, 1880.

ILLUSTRATIONS:—*Pl. 76.*

EXSICCATI:—Grout, N. Am. Musc. Pl. 395, Conn., duplicate type. (Type is in Cardot's Herbarium, according to G. E. Nichols.)

In a rocky brook, Connecticut.

Only one plant was available for the basis of this description. *F. Allenii* differs from other Lepidophyllae in leaves frequently subcarinate or carinate, margins rarely involute, and the very conspicuous alar cells. Although the apices and alar groups are similar to some in the Tropidophyllae, *F. Allenii* differs in cauline and branch leaves concave, and not keeled at base.

Sect. D. MALACOPHYLLAE Card. Mon. Font. 98. 1892.

Plants more or less flaccid, leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), subconcave or concave at base, plane or slightly concave above, more or less flaccid, commonly distant, up to 1.5 mm. apart, narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, gradually acuminate. Members of this section have been collected throughout the United States and in Canada.

KEY.

1. Leaves 4-ranked, plane to more or less concave, frequently subcarinate, narrowly lanceolate or oblong-lanceolate, 4–5 mm. long, 1–2 mm. wide	*21.*	*subcarinata.*
Leaves 3-ranked, usually plane or subconcave, occasionally concave, not subcarinate		2.
2. Leaf bases distinctly clasping the stem, alar cells enlarged, auricles evident, leaves oblong-lanceolate or ovate-lanceolate, more or less long and broadly acuminate.		3.
Leaf bases not distinctly clasping the stem		4.
3. Leaves 3.5–7 mm. long, 1–2.5 mm. wide, distant, up to 1.5 mm. apart; apices of perichaetial leaves slightly undulate; lamellae of peristome teeth 20–28	*17.*	*Lescurii.*
Leaves 3.5–5 mm. long, 0.75–1.50 mm. wide, rather close, up to 0.75 mm. apart; apices of perichaetial leaves not undulate; lamellae of peristome teeth 15–20	*17a.*	*Lescurii*, var. *ramosior.*
4. Majority of leaves 3.5–8 mm. long		5.
Majority of leaves 2.5–5.5 mm. long		6.
5. Leaves narrowly lanceolate to lanceolate, 4–8 mm. long, 0.50–1.5 mm. wide, very long and narrowly acuminate, apices frequently abruptly narrowed, auricles distinct	*18.*	*flaccida.*
Leaves ovate-lanceolate or oblong-lanceolate, 7–7.5 mm. long, 1.5–2 mm. wide, gradually acuminate, apices more or less broad, short, and truncate, auricles slight to distinct	*19.*	*denticulata.*
6. Leaves 4–5.5 mm. long, 0.65–1.10 mm. wide, apices short and broad, slightly and abruptly narrowed, with margins very frequently slightly involute on one side, usually appearing oblique	*20.*	*MacMillani.*
Leaves gradually acuminate, apices not oblique		7.
7. Leaves with majority of apices long and narrow		8.
Leaves with majority of apices short and broad		9.
8. Leaves narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, alar cells rather indistinct, auricles usually none	*13.*	*hypnoides.*
Leaves narrowly lanceolate, alar cells enlarged, auricles usually distinct	*15.*	*tenella.*
9. Leaves 2.5–4 mm. long, 0.75–1.35 mm. wide, alar cells more or less distinct, slight and distinct auricles frequent	*14.*	*nitida.*
Leaves 3–5 mm. long, 1–2.5 (occasionally up to 4) mm. wide, alar cells more or less enlarged, auricles none or very slight	*16.*	*Duriaei.*

13. FONTINALIS HYPNOIDES Hartm. Skand. Fl. (Ed. 4) 434. 1843.

Fontinalis squamosa L., var. *tenella* Bryol. Eur. **5**: *pl. 432.* 1851–1855.
Pilotrichum Strömbäckii C. Müll. Syn. **2**: 150. 1850.

Fontinalis Ravani Hy, Mem. Soc. Agr. Sci. & Arts d'Angers **24**: 127. 1882.
Fontinalis hypnoides Hartm., var. *Ravani* Card. Rev. Bryol. **18**: 83. 1891.

Plants flaccid, more or less delicate, bright green, pale green, yellowish-green, dull or glossy, sometimes darker below and with age; *stems slender*, 10–30 cm. long, more or less denuded at base, pinnately divided; branches very distant, erect or erect-spreading, short or elongate; *leaves more or less distant*, up to 1.5 mm. apart, erect-spreading or spreading, erect-imbricate at ends of stems and branches, *flaccid, usually plane*, some slightly concave, *narrowly lanceolate, oblong-lanceolate, or ovate-lanceolate, gradually acuminate, typically the acumen is long and narrow but occasionally short and broad*, 3–6 mm. long, 0.75–1.75 mm. wide, 3–5.5 : 1; *apices acute*, sometimes subacute, usually entire, sometimes denticulate; median leaf cells linear-attenuate or linear-rhomboidal, 8.5–15.5 μ wide, (according to Limpricht, 16–25 μ), 5–12 : 1; *alar cells usually more or less enlarged and rather indistinct*, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, *commonly not forming auricles*, rarely slight auricles occur; perichaetium oval or oblong; upper perichaetial leaves more or less broadly oval or suborbicular, rounded-obtuse or subapiculate, truncate and lacerate with age; *capsule usually one half emergent*, rarely immersed, *oval*, more or less contracted beneath mouth when dry, 2–2.4 mm. long and approximately 1 mm. in diameter; operculum short-conical; peristome orange-brownish, teeth linear, often united in pairs at the apex, more or less densely papillose, 0.75–0.80 mm. long, with 15–30 lamellae; *trellis perfect*, very muricate, almost spinulose, transverse strands complete and appendiculate; spores more or less muricate, usually 12–14 μ in diameter, the larger 16–20 μ in diameter (according to Limpricht), ripe in summer.

Type locality, Sweden.

Illustrations:—Bryol. Eur. l. c. H. J. Möller, Arkiv för Botanik **17**, No. 14, *figs. 32–34;* Roth, Eur. Laubm. **2**, *pl. 30;* Husnot, Musc. Gall. *pl. 81; Pl. 77.*

Exsiccati:—*Leiberg*, West American Mosses 137, Idaho; *Aven Nelson*, Plants of Wyoming 8002; Bryophytes of Wyoming 9671; *Baker*, Plants of West Central Colorado 631; *McIntosh*, 1, S. Dak.; *Holzinger & Elftman*, Mosses of Northern Minnesota, June 20, 1897; *Conard* (?), 27, Conn.; *Macoun*, Ont., Oct. 1870; Canadian Mosses 206, Ont.; Canadian Musci 604, Saskatchewan, 206, B. C.; Alberta, Aug. 9, 1904.

In sloughs, ponds, streams, rivers, and lakes, United States and Canada. Europe. Asia.

Cardot, (Mon. Font. 100 & 101), states that *F. hypnoides* is a polymorphic species and that both vegetative and fruiting structures show more or less variation. In examining a large number of specimens, I found that a few plants had long-acuminate leaves throughout, that the majority had both long- and short-acuminate leaves, and that the capsules varied from immersed to one-half emergent.

F. hypnoides is characterized by leaves more or less distant, up to 1.5 mm. apart, gradually acuminate, with acumen typically long and narrow but occasionally short and broad, apices commonly entire, sometimes subdenticulate or denticulate, alar cells slightly enlarged, usually more or less indistinct, not forming auricles or very rarely so, and trellis perfect.

14. Fontinalis nitida Lindb. et Arn. Musc. Asiae Bor., Part 2, 161. 1890.

Plants flaccid, delicate, yellowish-green, pale brownish-green, or yellowish-brown, sometimes slightly glossy above and dull below, darkening with age; *stems slender*, 15–40 cm. long, more or less denuded toward base, pinnately divided; branches distant, elongate, erect-spreading; leaves rather distant, up to 1 mm. apart, erect-spreading, subimbricate toward ends of stems and branches, *flaccid, usually plane*, occasionally slightly concave, *oblong-lanceolate or ovate-lanceolate, gradually acuminate, typically the acumen is short and broad but occasionally long and narrow*, 2.5–5 mm. long, 0.75–1.50 mm. wide, 2.5–5 : 1; *apices acute or subacute*, denticulate to entire; median leaf cells linear-attenuate or linear-rhomboidal, 8.5–15.5 μ wide, 6–15 : 1; *alar cells enlarged, more or less distinct*, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, *frequently forming slight auricles;* perichaetium oblong; upper perichaetial leaves oval or suborbicular, rounded or subapiculate, lacerate with age; *capsule usually completely immersed, oval*, 1.25–1.50 mm. long, 0.75–1 mm. in diameter; operculum short-conical; peristome reddish-orange; teeth linear, often united in pairs at the apex, more or less papillose, 0.65–0.75 mm. long, with 18–25 lamellae; *trellis perfect*, very muricate, almost spinulose; transverse strands complete and appendiculate; spores finely muricate.

Type locality, Siberia, Asia.

Illustrations:—*Pl. 77.*

Exsiccati:—*Allen*, North American Mosses A3, Ore.; *Leiberg*, Mosses from Kootenai Co., Idaho; *Baker*, Colo., Sept. 1, 1896; *Pringle*, Santa Rita Mts., Ariz., May 6, 1881; *Allen*, Conn. Mosses C_{20}; Grout, N. Am. Musc. Pl. 297, Quebec (Cardot's type collection for var. *angustiretis*); *Macoun*, Canadian

Musci 602, B. C., 604a, 759b, Ont.; Flora Canadensis 2615, B. C.; *Brinkman*, Bryophytes of S. and Cen. B. C., Canada 145.

In brooks, rivers, and lakes, United States and Canada. Asia.

Cardot, (Mon. Font. 104), states that *F. nitida* is only a regional race of *F. hypnoides*, and that they differ in very slight characters. It is frequently difficult to distinguish between the two species by means of one point of contrast. *F. nitida* usually has approximately the following combination of characteristics: commonly leaves smaller, less distant, apices more or less broad and short, frequently denticulate or subdenticulate, alar cells rather distinct, frequently forming slight auricles, and trellis perfect.

I have been unsuccessful in locating any description of the variety *angustiretis* Card. in litt., but I have examined several packets of sterile material belonging to the type collection and others determined by Cardot. I have concluded, without the aid of the original description, that *angustiretis* is not sufficiently different from the species to be worthy of varietal rank, and have combined the exsiccati of the species and variety.

15. Fontinalis tenella Card. Rev. Bryol. **18**: 83 & 85. 1891.

Plants very flaccid and delicate, yellowish or pale yellowish-green; *stems very slender*, 10–20 cm. long, more or less denuded at base, pinnately divided; branches elongate, rarely producing secondary branches; leaves up to 1 mm. apart, erect-spreading, *flaccid*, *usually plane*, some slightly concave, *narrowly lanceolate*, *very longly and gradually acuminate*, 2.5–5.5 mm. in length, 0.45–1.5 mm. wide, 3.5–6 : 1; *apices acute*, entire to denticulate; median leaf cells linear-attenuate or linear-rhomboidal, 6.5–12 μ wide, 7–16 : 1, (10–20 : 1, according to Cardot); *alar cells enlarged*, hyaline to yellowish-brown, rectangular, quadrate, or subhexagonal, *frequently forming slight, distinct auricles;* perichaetium oblong; upper perichaetial leaves oval or suborbicular, apices rounded, frequently apiculate, lacerate with age; *capsule immersed*, *oval or oblong*, 1.25–2 mm. long, 0.50–1 mm. in diameter; operculum short-conical; peristome orange-brownish or yellowish-brown, linear, often united in pairs at the apex, strongly papillose, 0.50–0.65 mm. long, with 15–20 lamellae; *trellis imperfect*, strongly muricate, *lower transverse strands incomplete;* spores finely muricate, 11.5–15.5 μ in diameter.

Type locality, Lake Pend d'Oreille, Idaho; collected by Leiberg.

Illustrations:—*Pl. 77.*

Exsiccati:—*Leiberg*, N. Am. Mosses 137, Idaho, assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in Herb. of The New York Botanical Garden; *Macoun*, Canadian Musci 207, B. C.; *Brinkman*, Bryophytes of S. and Cen. B. C. 247.

An accurate range of distribution is impossible with material available from two localities only. According to the specimens examined, this species occurs in western United States and Canada.

F. tenella differs from *F. hypnoides* in leaves smaller, narrowly lanceolate, very long acuminate, alar cells enlarged, frequently forming slight but distinct auricles, and trellis imperfect.

16. Fontinalis Duriaei Schimp. Syn. (Ed. 2) 555. 1876.

Fontinalis hypnoides Hartm., var. *Duriaei* Husnot, Muscol. Gall. 287. 1892.
Fontinalis obscura Card. Minn. Bot. Studies **3**^{2}: 120. *pl. 22.* 1903.

Plants flaccid, green, pale-green, olive-green, or yellowish-green, sometimes brownish, often blackish at base; stems slender, 10–30 cm. long, foliated to base or denuded, pinnately divided; branches distant, numerous, unequal in length, erect to spreading; leaves more or less distant, 0.5–1.5 mm. apart, occasionally subimbricate, imbricate at ends of branches, spreading or erect-spreading, flaccid to more or less firm, plane to subconcave, sometimes with slight longitudinal folds, (margins on one side occasionally slightly reflexed, according to Limpricht), *oblong-lanceolate to more or less broadly ovate-lanceolate*, occasionally subovate, *short and broadly acuminate*, 3–5 mm. long, rarely cauline leaves up to 7 mm. in length, 1–2.5 mm. wide (up to 4 mm. in width, according to Limpricht), 2–5.5 : 1; apices acute to subobtuse, denticulate to entire; median leaf cells linear-attenuate or linear-rhombic, 8.5–17 μ wide, 6–18 : 1; *alar cells more or less enlarged*, hyaline to yellowish-brown, rectangular, subquadrate, quadrate, or subhexagonal, *auricles none or very slight;* perichaetium oblong; upper perichaetial leaves oval-suborbicular, broadly rounded at apex or apiculate, lacerate with age; *capsules immersed*, *oval or short oblong*, not contracted beneath mouth when dry, approximately 2 mm. long, 1–1.25 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear, papillose, 0.75–0.90 mm. long, frequently united in pairs at the apex, with 15–35 lamellae; *trellis perfect*, muricate, transverse strands complete, lower ones appendiculate; spores finely muricate or smooth, 15–20 μ in diameter; ripe in summer.

Type locality, LaCalle, Algeria, Africa; collected by Durieu in 1840.

ILLUSTRATIONS:—Husnot, Muscol. Gall. *pl. 81;* Roth, Eur. Laubm. 2: *pl. 30; Pl. 77.*

EXSICCATI:—*Ren. & Card.*, Musc. Am. Sept. Exsicc. Sept. 382, 383, Minn.; *Grout*, N. Am. Musc. Pl. 190, Minn., 404, N. Dak.; *Holzinger*, Mosses of North-eastern Minn., July 28, 1902; *Williams*, 82, Mont.; *Jones*, Utah, July 12, 1886; *Pringle*, Santa Rita Mts., Ariz., May 6, 1887; *Bolander*, 79, Cal.; *Bush*, Eagle Rock, Mo., June 17, 1897; *Deam*, Flora of Indiana 49117; *Nichols*, Mich., Aug., 1926; C_4, $C_6{}^a$, $C_6{}^b$, Conn.; *Lawson*, Canadian Musci 995; *MacFadden*, 730, B. C.

In streams and falls, and occasionally in swamps, in United States and Canada. Europe. Africa.

It is possible that an error has been made in considering *F. obscura* as a synonym of *F. Duriaei*, because the plants of *F. obscura* examined were sterile and from two localities only. However, I was unable after making a thorough study, to discover any constant distinguishing characteristics. *F. Duriaei* is a variable species and it seems that some of the smaller forms with closer and narrower leaves were named *F. obscura*. Cardot states that the plants of *F. obscura* are dark green or blackish and that the leaves are fragile or brittle. I believe this is due to a deposit of unknown nature which covers the older leaves. The younger leaves are yellowish-green.

F. Duriaei resembles *F. hypnoides* but it can be recognized by plants generally more robust, leaves usually broader, short and broadly acuminate, apices acute to subobtuse, entire to denticulate, alar cells more or less distinct, capsules immersed, and not contracted beneath mouth when dry.

On packets of material determined by Cardot, I have found the names *F. Duriaei*, forma *latifolia* and forma *integrifolia*. After a very careful search for the descriptions, nothing has been found concerning these forms.

17. FONTINALIS LESCURII Sull. Mosses U. S. 1856.

Plants flaccid, golden to green; *stems slender, up to 40 cm. in length*, denuded and usually darker at base, irregularly pinnately divided; branches more or less numerous, distant, slender, commonly elongate; *leaves distant*, up to 1.5 mm. apart, erect-spreading or loosely imbricate, *flaccid, clasping and more or less concave at base, commonly plane above*, frequently slightly concave, *oblong-lanceolate or ovate-lanceolate, more or less longly and broadly acuminate*, 3.5–7 mm. long, 1–2.5 mm. wide, 2.5–3.5 : 1; *apices usually acute*, occasionally subobtuse, *denticulate or subdenticulate;* median leaf cells linear or linear-rhombic, 8.5–12 μ wide, 10–15 : 1; *alar cells enlarged*, hyaline to yellowish or brownish, rectangular, quadrate, or subhexagonal, *commonly forming distinct auricles.* According to Cardot and Sullivant, perichaetium subcylindric; *upper perichaetial leaves broadly oval*, tubulose, enfolding capsule, *apices slightly undulate*, rounded-obtuse, truncate and lacerate with age; *capsule immersed, subcylindric*, not contracted beneath mouth when dry, 2–2.5 mm. long, 0.65 mm. in diameter; operculum conical; peristome orange-brownish, teeth linear-acuminate, subulate, papillose, 0.75–1 mm. long, with 20–28 lamellae; *trellis imperfect*, slightly muricate, *cilia united at apex only, free at base appendiculate;* spores about 20 μ in diameter, mature in summer.

Type locality, Falls of Little River, Lookout Mountain, Alabama; collected by Lesquereux.

ILLUSTRATIONS:—Sull., Icones Musc. *pl. 61;* Grout, M.H.M. *pl. 87; Pl. 78.*

EXSICCATI:—*Sull. & Lesq.*, Musc. Bor. Am. (Ed. 1) 228, (Ed. 2) 340 in part; *Pringle*, Vt., June 19, 1880; *Grout*, near Plymouth, N. H., Oct. 4, 1897; *Conard*, 237, N. Y.; *Nichols*, Conn., April 14, 1911; *Naylor*, near Greencastle, Ind., Aug., 1906; *Sharp*, Bryophytes of Highlands, N. C., 108; *Meeker*, Kans., in 1900; *Macoun*, N. S., sheet no. 3958 in National Museum of Canada.

In streams, Nova Scotia to Alabama and west to the Rocky Mountains. It has been reported as occurring in Oregon but I have seen no specimens collected west of Kansas.

F. Lescurii is a very difficult moss to determine. It is frequently confused with *F. dalecarlica, F. Novae-Angliae, F. hypnoides*, and *F. tenella. F. Lescurii* is characterized by plants flaccid, leaves more or less distant, flaccid, clasping and more or less concave at base, plane or slightly concave at apex, oblong-lanceolate or ovate-lanceolate, more or less long and broadly acuminate, apices usually acute, occasionally subobtuse, denticulate or subdenticulate, and auricles generally distinct.

17a. FONTINALIS LESCURII Sull., var. RAMOSIOR Sull. Icones Musc. 101. 1864.

Fontinalis Frostii Sull. in litt., according to Cardot.
Fontinalis Eatoni Sull. in Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 224c. 1856.
Fontinalis Sullivantii Lesq. & James, Man., 271, 1884, not Lindb.

Plants more slender than the species; branches more elongate; *leaves closer*, commonly 0.50–0.75 mm. apart, *narrower*, 3–5.5 mm. long, 0.75–1.50 mm. wide, 3–4.5 : 1; *perichaetial leaves shorter*, 2–2.5 mm. long, *very concave, not undulate at apex;* capsule 2–3 mm. long, 0.75–1 mm. in diameter, operculum about 1 mm. in length; teeth of peristome slightly shorter, approximately 0.65 mm. in length, *with less numerous and more distant lamellae*, commonly 15–20; spores 15–20 μ in diameter.

Type locality, Cheshire Co., New Hampshire; collected by Frost and Eaton, 1858.

ILLUSTRATIONS:—Sull., Icones Musc. *pl. 62; Pl. 78.*

EXSICCATI:—*C. C. Frost*, near Brattleboro, Vt., 1858, ex herb. D. C. Eaton, in herb. of the New York Botanical Garden, assumed to be a duplicate of the type.

If it were not for the difference in the perichaetial leaves and the peristome, I should consider the specimens examined as *F. Lescurii* because *F. Lescurii* is a species which shows great variation. Without fruit it is difficult to distinguish between *F. Lescurii* and var. *ramosior* because the plants of the variety can be considered as small forms of the species.

According to Cardot, the two localities frequently given for the type are one because the collectors located the collection from different points, one giving Cheshire Co., New Hampshire, and the other near Brattleboro, Vermont. Brattleboro is on the west side of the Connecticut River which separates Vermont and New Hampshire.

Students of Fontinalaceae have placed *F. Eatoni* Sull. in the synonymy of *F. antipyretica* L., var. *gigantea* Sull. and *F. Novae-Angliae* Sull. The leaves are not keeled-conduplicate. Therefore, it can not be considered correctly as a synonym of species or varieties in Tropidophyllae. I have had very small portions of the plant for study. However, the fragments examined have been from Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 224c, 1856, collected by D. C. Eaton in Cheshire Co., New Hampshire. The leaf apices from one branch resemble those of *F. Novae-Angliae* and those from another branch resemble the apices of *F. Lescurii.* The form, size, distance, apices, bases, auricles, and areolation of many leaves compare rather closely with those of *F. Lescurii*, var. *ramosior.* For these reasons, in the absence of capsules and complete specimens for study, I consider *F. Eatoni* Sull. as a synonym of *F. Lescurii* Sull. var. *ramosior* Sull. It is quite possible that, instead, it should be placed in the synonymy of *F. Lescurii*, but more material for study is needed to make a final decision.

18. FONTINALIS FLACCIDA Ren. & Card. Bot. Gaz. **13**: 201. 1888.

Plants flaccid, some slightly rigid, *delicate*, yellowish or yellowish-green; *stems slender*, up to 40 cm. in length, blackish and denuded at base, pinnately divided; branches very distant, erect-spreading, slender; *leaves very distant*, up to 1.5 mm. apart, imbricate at end of branches, spreading or erect-spreading, *very flaccid, subconcave to concave at base, plane or very slightly concave at apex, narrowly lanceolate to lanceolate, very long and narrowly acuminate*, 4–8 mm. long, 0.50–1.50 mm. wide, 3–6 : 1; *apices very frequently abruptly narrowed, obtuse to truncate*, occasionally acute, *denticulate*, sometimes almost entire; median leaf cells linear-attenuate, 8.5–10 μ wide, 10–15 : 1, occasionally up to 20 : 1; *alar cells large to very large*, hyaline to yellowish or brownish, rectangular or subhexagonal, *forming distinct auricles.* According to Cardot, perichaetium subcylindric; upper perichaetial leaves broadly oval, truncate and lacerate with age; *capsule immersed, subcylindric*, not contracted beneath mouth when dry, 2 mm. long, 0.50 mm. in diameter; operculum conical; peristome orange-brownish, teeth narrowly linear-acuminate, often united in pairs at apex, slightly papillose, 0.65–0.75 mm. in length, with 18–20 lamellae; *trellis imperfect*, muricate; spores very finely muricate or almost smooth.

Type locality, Bayou Bonfouca, Louisiana; collected by the Rev. A. B. Langlois, March 24, 1886.

ILLUSTRATIONS:—Bot. Gaz. **13**: *pl. 19; Pl. 78.*

EXSICCATI:—*Langlois*, Flora Louisiana 140, type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, and in United States National Herbarium; *Sull. & Lesq.*, Musc. Bor. Am. (Ed. 2) 340 in part, according to Cardot; *Nichols*, Connecticut Mosses, C_{21}.

In stagnant or running water in Louisiana and Connecticut; according to Cardot, also in Alabama and New Hampshire. Nichols, in Rhodora **15**: 10, 1913, reports it, in addition, in Massachusetts, Maryland, Georgia, Ohio, Missouri, and British Columbia.

Fontinalis flaccida is distinguished from other species of Malacophyllae by its very flaccid, narrowly lanceolate, very long and narrowly acuminate leaves, with apices very frequently abruptly narrowed, obtuse, subobtuse, or truncate, occasionally acute, commonly denticulate, and alar cells large and rectangular to subhexagonal.

A careful search for the original description of *F. flaccida* forma *minor* which appears on a packet of material determined by Cardot was unsuccessful. It does not differ materially from the type.

19. FONTINALIS DENTICULATA Kindb. Hedwigia **36**: 61. 1897.

Plants very flaccid, yellowish or yellowish-green; stems at least 10 cm. long, denuded at base, pinnately divided; *leaves distant*, subimbricate to imbricate at ends of stems or branches, erect or erect-spreading, *flaccid, plane, ovate-lanceolate or oblong-lanceolate, gradually narrowed toward more or less blunt apex*, 7–7.5 mm. long, 1.5–2 mm. wide, 3.5–4.5 : 1; *apices short, more or less broad, sub-obtuse to more or less truncate, denticulate;* median leaf cells linear-attenuate, 6.5–10 μ wide, 8–16 : 1, occasionally 20 : 1; *alar cells commonly enlarged*, hyaline subhyaline, or yellowish, rectangular to subhexagonal, *auricles slight to distinct;* fruit unknown.

Type locality, near St. Louis, Missouri; collected by Dr. Engleman, in 1889 or 1891.

ILLUSTRATIONS:—*Pl. 77.*

EXSICCATI:—Specimen assumed to be duplicate type, determined by Röll, ex herb. Berlin, in herb. of New York Botanical Garden.

A very small amount of sterile material was available for study. The length given in the description is that of the material studied. Kindberg gives no length in his description. The leaves of *F. denticulata* resemble those of *F. flaccida*. It is impossible to determine definitely whether or not there is any relationship between the two plants with the material at hand. *F. denticulata* is characterized by long, flaccid, plane, ovate-lanceolate or oblong-lanceolate leaves which are gradually narrowed toward the short, broad, more or less truncate or obtuse, denticulate apices.

20. FONTINALIS MACMILLANI Card. Rev. Bryol. **23**: 71. 1896.

Plants more or less flaccid, dull green or yellowish-green; stems about 10 cm. long, slightly denuded at base, irregularly pinnately divided; leaves slightly distant, flaccid or more or less firm, erect-spreading, slightly imbricate to imbricate at end of branches and stems, concave at base, plane or more or less concave above, *narrowly lanceolate, or oblong-lanceolate, shortly and broadly acuminate, slightly and abruptly narrowed near the point*, 4–5.5 mm. long, 0.65–1.10 mm. wide, 3.5–6 : 1; *apices acute or subacute, denticulate or subdenticulate, frequently more or less twisted, margins usually slightly involute on one side, causing apices to have an oblique appearance*, median leaf cells linear-attenuate, 8.5–12 μ wide, 12–16 : 1; alar cells more or less enlarged, hyaline, subhyaline, or yellowish, rectangular, quadrate, or subhexagonal, auricles slight or none; fruit unknown.

Type locality, northern Minnesota, near International Boundary; collected by Prof. Conway MacMillan, 1895.

ILLUSTRATIONS:—*Pl. 79.*

EXSICCATI:—*MacMillan*, Mosses of Minnesota, Sept., 1895, type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris.

It is impossible to determine a definite relationship between *F. MacMillani* and other species in Heterophyllae and Lepidophyllae because the material obtainable for study was sterile and small in amount; difficulties were increased because the leaves were covered with "Cocconéidées" (according to Cardot), and the apices had been partially destroyed by some parasite. The more or less concave and firm leaves are characteristic of the Lepidophyllae, but the leaf shape, alar groups, bases, and apices resemble those of Malacophyllae. Since the plants resemble those of the latter group and since Cardot, with type material at hand, placed *MacMillani* in the Malacophyllae, I am continuing this classification of the species. *F. MacMillani* is characterized by leaves narrowly lanceolate or oblong-lanceolate, short and broadly acuminate, slightly and abruptly narrowed near the point, and apices more or less acute and denticulate, frequently more or less twisted, and margins usually slightly involute on one side.

21. FONTINALIS SUBCARINATA Card. Bot. Gaz. **37**: 376. 1904.

Plants flaccid, yellowish, yellowish-green, or dull-green; stems 15–20 cm. long, denuded below, pinnately divided; branches elongate, more or less erect; *leaves rather distant*, approximately 1 mm. apart, erect or slightly erect-spreading, *4-ranked, flaccid, plane to more or less concave, frequently longitudinally sulcate in the middle, narrowly lanceolate or oblong-lanceolate, long acuminate*, 4–5 mm. long, 1–2 mm. wide, 2.5–5 : 1; *apices acute*, occasionally subacute, *entire*, some subdenticulate or denticulate; median leaf cells linear-attenuate, 8.5–13.5 μ wide, 10–15 : 1; *alar cells slightly enlarged, frequently rather indistinct*, subhyaline, yellowish, or yellowish-brown, rectangular, subquadrate, subrounded, or subhexagonal, *auricles usually none or rarely very slight;* fruit unknown.

Type locality, Cypress Hills along Battle Creek, Assiniboia, Canada; collected by Macoun, 1895.

ILLUSTRATIONS:—Bot. Gaz. **37**: *pl. 23–2b; Pl. 79.*

EXSICCATI:—*Macoun*, 264, assumed to be type or duplicate type, in Herb. Lab. de Cryptogamie, Muséum d'Histoire Naturelle, Paris, Canadian Cryptogams, sheet 4389 in National Museum of Canada.

The specimens studied were collected in Saskatchewan, Canada.

F. subcarinata is characterized by the flaccid, plane or slightly concave, narrowly lanceolate or oblong-lanceolate leaves, frequently subcarinate or sulcate, apices usually acute and entire, alar cells slightly enlarged, more or less indistinct, and auricles usually none or rarely very slight.

Sect. E. STENOPHYLLAE Card. Mon. Font. 122. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shap or size present), rather firm, narrowly lanceolate, long linear-acuminate, and more or less canaliculate. The only specimen reported for this section was collected in Minnesota.

22. FONTINALIS DICHELYMOIDES Lindb. Öfvers. Finska Vet.-Soc. Förhandl. **12**: 76. 1869.

Plants more or less flaccid, slightly glossy, yellowish above, dull brown below; *stems slender*, 6–20 cm. in length, not denuded at base or only slightly so, more or less regularly pinnately divided; branches distant, erect-spreading, more or less elongate, 5–15 mm. long, slightly attenuate, often curved at the ends; *leaves more or less distant*, approximately 1 mm. apart, *erect-spreading or secund*, firm, *narrowly lanceolate, margins involute, canaliculate, long-acuminate*, 3–4.5 mm. long, 0.35–0.60 mm. wide, occasionally up to 1 mm. wide, 4.5–5 : 1; *apices commonly acute*, also subacute to obtuse, *typically entire*, sometimes subdenticulate; median leaf cells linear-attenuate, 8.5–10 μ wide, 10–30 : 1; alar cells enlarged, hyaline to yellowish or brownish, rectangular, subrectangular, or subhexagonal, auricles commonly very apparent and slightly convex; fruit unknown or incompletely known.

Type locality, Lake Piojärvi, Finland; collected by Brotherus, Aug. 7, 1869.

ILLUSTRATIONS:—Roth, Eur. Laubm. **2**: *pl. 31;* Engler and Prantl (Ed. 2) **11**: *fig. 476;* H. J. Möller, Arkiv för Botanik **17**: no. 14, *figs. 26–28* and *pl. 8, no. 15; Pl. 79.*

EXSICCATI:—*Brotherus*, Lake Piojärvi, Finland, Aug. 7, 1869, from Herb. S. O. Lindberg, assumed to be type or duplicate type, in Herb. of New York Botanical Garden; *Arthur*, Vermilion Lake, Minn., July 21, 1886.

In Lake Vermilion, Minn., according to only material available. Also in Europe.

Only a small amount of the material from Vermilion Lake has been available. It compares favorably with the Brotherus specimens cited, with the exception that the Minnesota plant is slightly more robust and less flaccid, the leaves are more or less subimbricate, about 0.5 mm. apart, and more firm. It seems that the *Fontinalis* from Lake Vermilion resembles the Piojärvi specimen sufficiently to be considered as *F. dichelymoides*. Limpricht, Möller, and Cardot state in their descriptions that the fruit is unknown. However, Cardot mentions in his notes that the perichaetial leaves are broadly oval, rounded or truncate, and slightly lacerate at apex or short-apiculate.

Sect. F. SOLENOPHYLLAE Card. Mon. Font. 124. 1892.

Leaves more or less uniform (cauline leaves and branch leaves similar with intergradations in shape or size present), more or less firm when moist, narrowly lanceolate, very concave, subtubulose, or tubulose. The common range of the members of this section is southern and south-central United States.

KEY.

Plants very slender, very delicate, stems slender to filiform, 10–20 cm. in length, leaves up to 2 mm. apart, long-acuminate, almost subulate, convolute-tubulose, and apices acute. *23. filiformis.*

Plants slender, delicate, stems slender, 4–10 cm. in length, leaves up to 1 mm. apart, rarely long and narrowly acuminate, more or less tubulose, and apices commonly more or less obtuse. . . . . *24. Langloisii.*

23. FONTINALIS FILIFORMIS Sull. & Lesq. in Lesq. & James, Mosses of North America 271. 1884.

Fontinalis disticha Hook. & Wils., var. *tenuior* Sull. Icones Musc. 103. 1864.
Fontinalis filiformis Sull. & Lesq., var. *tenuifolia* Card. Mon. Font. 126. 1892.

Plants very slender, very delicate, yellowish or yellowish-green; *stems more or less rigid, slender to filiform*, 10–20 cm. long, denuded and blackish at base, pinnately divided; branches distant, *distichous*, erect-spreading, *filiform*, and plumose; *leaves very distant*, up to 2 mm. apart, erect or erect-spreading, *firm when wet, narrowly lanceolate, long-acuminate, almost subulate, convolute-tubulose*, 3–6 mm. long, 0.35–0.50 mm. or more wide (unrolled), about 8–10 : 1; *apices acute, subdenticulate or denticulate;* median leaf cells linear-rhombic, 6.5–12 μ wide, 6–15 : 1; alar cells slightly enlarged, hyaline, subhyaline, or yellowish, rectangular or subhexagonal, usually forming distinct auricles; perichaetium narrowly cylindric; perichaetial leaves oval-oblong, rounded or subapiculate, lacerate with age; *capsule narrowly cylindric*, immersed, 2.5 mm. long, 0.35–0.50 mm. wide; operculum conic-acuminate; peristome orange-brownish, lanceolate-subulate, papillose, approximately 0.60 mm. in length, with 17–28 lamellae; cilia rudimentary, short, up to 0.40 mm. in length, appendiculate, some connected by a few, smooth, transverse strands.

Type locality, Southern Kentucky; collected by Lesquereux.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 64: Pl. 79.*
EXSICCATI:—*Sull. & Lesq.*, Musc. Bor. Am. (Ed. 2) 339 in part; *Austin*, Musc. Appal. 250; *Ren. &*

Card., Musc. Am. Sept. Exsicc. 230, La.; *Lesquereux*, southern Ky., ex herb. C. F. Austin; *Demetrio*, 7, Mo.; *Langlois*, near St. Martinsville, La. 1892; Bois Lobbé, La., Aug. 6, 1892, March 14, 1893; La., March 15, 1898; Flora Ludoviciniana 746.

In stagnant water, southern United States.

Fontinalis filiformis is the most delicate species in the genus. It is further characterized by leaves firm when wet, narrowly lanceolate, long-acuminate, convolute-tubulose, apices acute, and capsule narrowly cylindric.

I can find no apparent difference between sterile and fruiting plants of the var. *tenuifolia* and the species. Several specimens, including duplicates of the type, were examined and leaves were firm when wet instead of very flaccid as described by Cardot. The leaf ranges in size recorded for the variety also occur in the species. No outstanding difference in size between plants of the species and the variety were found.

24. Fontinalis Langloisii Card. Rev. Bryol. 84 & 86. 1891.

Plants slender, delicate, more or less rigid, yellowish or yellowish-green above, dull green or darker green below; *stems slender, short*, 4–10 cm. long, denuded and blackish below, pinnately or bipinnately divided; branches distant, distichous, slender, delicate, plumose, erect-spreading; *leaves about 1 mm. apart*, firm when moist, erect-spreading to subimbricate, *narrowly lanceolate, more or less tubulose*, 3–3.5 mm. long, occasionally 4–5 mm. in length, 0.45–0.65 mm. wide, occasionally 0.75 mm. in width, 6 : 1; *apices typically obtuse or subobtuse*, some subacute, rarely acute, *frequently slightly cucullate*, entire to denticulate; median leaf cells linear-rhombic, 6.5–13.5 μ wide, 9–16 : 1; alar cells slightly enlarged, hyaline to yellowish, rectangular, quadrate, or subhexagonal, auricles slight or none; perichaetium cylindric; perichaetial leaves lacerate with age; *capsule cylindric*, 1.75–2 mm. long, approximately 0.5 mm. in diameter; smooth, 18.5–24 μ in diameter.

Type locality, Ravine-aux-Cannes, near Mandeville, La.; collected by the Rev. A. B. Langlois, Oct. 1, 1890.

Illustrations:—*Pl. 79.*

Exsiccati:—*Ren. & Card.*, Musc. Am. Sept. Ex. 229, 231, La.; *Grout*, N. Am. Musc. Pl. 387, La.; *Langlois*, Flora Ludoviciana 648; 518, 814, 816², La.; *Cellestin*, 816, La.

In ponds, ravines, and bayous, in Louisiana.

Fontinalis Langloisii is quickly recognized by plants short, slender, delicate, branches pinnate, leaves narrowly lanceolate, more or less tubulose, apices usually more or less obtuse and denticulate, and frequently slightly cucullate.

No description of the fruit was found. Upon one plant, N. Am. Musc. Pl. 387, I found old capsules which served as the basis for my incomplete description of the fruit.

Fontinalis involuta R. & C., forma *angustifolia* (Cardot?) occurs on two collections made by Langlois, Oct. 6, 1891, Abita, La., numbers 745 & 745b. The search for a description of this form was unsuccessful. "Foliis angustioribus.—(4–5 mm. long. ½–⅔ mm. lates) longuis acuminatis, subacutis" is written on the packet, no. 745, which was sent to me from Paris by Allorge. I have examined the material carefully and have concluded that probably the plants should be considered as *F. Langloisii*.

2. BRACHELYMA Sch. Syn. (Ed. 2) 557. 1876.

Fontinalis sp. P. B. Prodr. 58. 1805.
Dichelyma sp. Myr. in Act. Reg. Acad. Scient. Holm. 274. 1832.
Cryphaea sp. Nees in Pflanz. Maxim. von Wied, Reise Nord-Amerika **2**: 27. 1841.
Neckera Sect. 9, *Dichelyma* Subsect. 2, *Cryphaeadelphus* C. Müll. Syn. **2**: 145. 1851.
Cryphaeadelphus (C. Müll.) Card. in Rev. Bryol. **31**: 6. 1904.

Plants submerged and floating, slender to more or less robust; stems slender, denuded at the base; leaves tristichous, costate, oblong-lanceolate, carinate-conduplicate, apices acute or obtuse, denticulate to subentire; median leaf cells hexagonal-rhombic or linear-attenuate; alar cells rectangular, auricles not distinct; perichaetium oblong; perichaetial leaves imbricate, ecostate, concave, lanceolate, acuminate, entire; capsule very shortly pedicellate, completely immersed; operculum rostrate; calyptra split along one side, small, covering only the operculum; peristome double, teeth linear, with few lamellae, erect, cilia longer than the teeth, nodulose or appendiculate, free or united at the apex by transverse strands; spores yellowish, almost smooth.

The plants of this genus resemble those of *Fontinalis* in leaf forms and capsules immersed, and those of *Dichelyma* in leaves costate, calyptra split along one side, and in outer peristome structure. *Brachelyma* has been reported from the United States only.

KEY.

Plants usually slender and more or less flaccid; stems pinnately branched; leaf apices acute to subobtuse; interior cells rather short hexagonal-rhombic, 2–4 : 1, sometimes 6–7 : 1. *1. subulatum.*

Plants usually robust and rigid; stems pinnately or bipinnately branched; leaf apices subobtuse to obtuse; interior cells linear-rhombic or linear-attenuate, 6–9 : 1 ..... *2. robustum.*

1. BRACHELYMA SUBULATUM (P. B.) Sch. Syn. (Ed. 2) 557. 1876.

Fontinalis subulata P. B. l. c.
Dichelyma subulatum Myr. l. c.
Cryphaea inundata Nees l. c.
Neckera subulata C. Müll. Syn. l. c.
Cryphaeadelphus subulatus (P. B.) Card. Rev. Bryol. **31**: 6. 1904.

Plants floating, flaccid, dull green or yellowish; *stems slender,* 12–20 cm. long, denuded at the base, *regularly pinnately divided;* branches very distant, unequal, spreading, occasionally slightly curved; *leaves* slightly distant on the stem and principal branches, much closer on the younger growth, *tristichous,* erect-spreading or loosely imbricate, *keeled-conduplicate,* decurrent, *oblong-lanceolate, acuminate,* 2–4 mm. long, 0.35–1 mm. wide, 3.5–7 : 1; *costa percurrent* or disappearing slightly below apex; apices acute to obtuse, more or less denticulate; *median leaf cells short,* irregular, *hexagonal-rhombic,* 5–8.5 μ wide, 2–4 : 1, sometimes 6–7 : 1; the *marginal linear-attenuate,* 6.8–8.5 μ wide, 10–15 : 1, forming a marginal zone of 4 or 5 rows of cells, less distinct or disappearing toward the apex; *alar cells and basal cells quadrate or rectangular,* auricles not distinct. According to Cardot, perichaetium oblong; perichaetial leaves ecostate, oblong-lanceolate or linear-lanceolate, rather long-acuminate, entire; seta very short, 1–1.5 mm. long; capsule completely immersed, pale yellowish, oval, 1.5–2 mm. long, 0.75–1 mm. in diameter; operculum convex-conical; beak oblique; *calyptra small, very fugacious, covering only the operculum;* peristome yellowish, teeth linear, finely granulose, with 8–10 lamellae; cilia narrow, finely papillose, nodulose, or appendiculate, united or free at the apex.

Type locality, Georgia; collected by Palisot de Beauvais. Holmes Co. Fla.

ILLUSTRATIONS:—Bry. Eur. *pl. 434;* Myrin, l. c. *pl. 7B;* Engler & Prantl (Ed. 2) **11**: fig. 477; *Pl. 79.*
EXSICCATI:—*Drumm.* Musc. Am., S. States 153, *Small,* Georgia Mosses 5068, 5079; *Harper,* Alabama Plants 104; *Langlois,* La., July 9, 1893; *Mohr,* Mobile, Ala.; *Schallert,* 514, N. C.
In streams and rivers, in Louisiana, Alabama, and Georgia; also in Arkansas and Illinois, according to Cardot.
B. subulatum is easily distinguished by plants slender, leaves keeled-conduplicate, costate, median leaf cells hexagonal-rhombic, marginal zone of four or five rows of cells linear-attenuate, alar cells small, quadrate to rectangular.

2. BRACHELYMA ROBUSTUM (Card.) E. G. Britt. Bryol. **7**: 48. 1904.

Cryphaeadelphus robustus Card. Rev. Bryol. **31**: 8. 1904.

Plants floating, rather robust, rigid, yellowish-green to dull or brownish-green; stems 10–20 cm. long, denuded at the base, pinnately to bipinnately branched; *branches* numerous, *rigid,* spreading; *leaves close, very distinctly tristichous,* erect-spreading, subimbricate or imbricate, *keeled-conduplicate,* decurrent, *oblong-lanceolate, gradually and broadly acuminate,* 3–4 mm. long, 1–1.5 mm. wide, 2–3 : 1; costa percurrent or disappearing slightly below the apex; *apices obtuse, more or less broad and cucullate,* subentire to denticulate; *interior leaf cells linear-rhombic or linear-attenuate,* only slightly shorter than the linear-attenuate marginal cells, 6.5–8.5 μ wide, median 6–9 : 1, marginal 10–13 : 1; *alar cells and basal cells rectangular or quadrate,* not forming auricles. According to Cardot, perichaetial leaves like those of *B. subulatum.*

Type locality, Limestone Creek, Pulaski Co., Georgia; collected by Roland M. Harper in 1902.

ILLUSTRATIONS:—*Pl. 79.*
EXSICCATI:—*Harper,* Georgia Plants 1919a, near Colquitt, Miller Co., Aug. 4, 1903, assumed to be cotype or duplicate type; 2142a, near Dublin, Apr. 21, 1904; 1377a, Pulaski Co., June 27, 1902.
This species has been reported only from the swamps in Georgia.
B. robustum is distinguished from *B. subulatum* by plants more or less robust, rigid, pinnately to bipinnately branched, leaves very distinctly tristichous, apices obtuse, more or less broad and cucullate, median leaf cells linear-rhombic or linear-attenuate and slightly shorter than the linear-attenuate marginal cells.

3. DICHELYMA Myr. in Act. Reg. Acad. Scient. Holm. 274. 1832 (emend.).

Fontinalis sp. Hedw. Descr. **3**: 57. 1792.
Neckera Sect. 9, *Dichelyma* Subsect. 1, *Eudichelyma* C. Müll. Syn. **2**: 143. 1850.

Plants growing at edge of water, inundated or entirely submerged; slender to robust, green to golden-brown, blackish below, variously branching; branches recurved at apex; leaves tristichous, narrowly lanceolate to lanceolate-subulate, falcate-secund to circinate, keeled-conduplicate, slightly denticulate; costa percurrent to long-excurrent; median leaf cells linear-attenuate; basal cells shorter; alar cells no wider or very slightly so, yellowish; auricles none; perichaetium very elongate-cylindrical; perichaetial leaves long, convolute or tubular, more or less spirally twisted around the seta, strap-shaped or linear-acuminate, ecostate, apices entire or slightly denticulate. Capsule ovate, rather long pedicellate, surpassing the perichaetium or emerging laterally; operculum conic-rostrate, about as long as urn, frequently oblique and curved; calyptra split along one side, large, covering the entire capsule; peristome double, teeth 16, lance-linear, erect, obtuse, papillose, frequently more or less cleft along the median line, with few distant lamellae; cilia filiform, generally longer than the teeth, occasionally falling with the operculum, sometimes free, sometimes united at the apex by transverse strands, or forming a perfect trellis; transverse strands not appendiculate; spores small and more or less uniform in size.

The plants of this genus are distinguished from those of *Fontinalis* by their distinctive habit; leaves costate, midrib often excurrent; perichaetium very elongate-cylindric, perichaetial leaves strap-shaped or linear-acuminate, generally spirally twisted; calyptra split along one side, entirely covering the capsule; peristome teeth with fewer lamellae, meshes of trellis not wider than high, and transverse bars never appendiculate. *Dichelyma* differs from *Brachelyma* chiefly in leaves narrowly lanceolate, homotropous-falcate, perichaetium very elongate-cylindrical, perichaetial leaves convolute, more or less spirally twisted, strap-shaped or linear-acuminate, capsule long-pedicellate, surpassing the perichaetium, and calyptra covering the entire capsule. *Dichelyma* has been reported from North America, Europe, and Asia.

Key.

1. Costa subpercurrent, percurrent, or briefly excurrent ..... 2.
   Costa long-excurrent ..... 3.
2. Costa percurrent or briefly excurrent, leaves acuminate-subulate; inner perichaetial leaves strap-shaped, long-acuminate; capsule emerges at end of perichaetium; trellis perfect ..... 1. *falcatum.*
   Costa subpercurrent or percurrent, leaves acuminate, acute to obtuse; inner perichaetial leaves linear, long-acuminate; capsule emerges laterally from perichaetium; trellis imperfect, cilia free with exception of apices united by 2 or 3 transverse strands. . . 4. *pallescens.*
3. Leaves falcate-secund, 4–5 mm. long, apices long-subulate; inner perichaetial leaves linear, rather long-acuminate, not twisted or only slightly so; capsule erect, reaching apices of perichaetial leaves or surpassing them; trellis perfect ..... 2. *uncinatum.*
   Leaves erect-spreading or subsecund, the younger frequently falcate-secund, 5–7 mm. long, apices long-subulate; inner perichaetial leaves acuminate, spirally twisted; capsule erect or oblique, at first immersed, later laterally emergent; trellis imperfect, cilia free with exception of apices united by 2 or 3 transverse strands 3. *capillaceum.*

1. Dichelyma falcatum (Hedw.) Myr. l. c.

Fontinalis falcata Hedw. Musc. Frond. **3**: 57. 1792. and Sp. Musc. 299. 1801.
Neckera falcata C. Müll. l. c. 143.

Plants commonly glossy and bright green when young, later yellowish-green, brownish, or copper-colored above, often blackish below; stems 5–15 cm. or more long, irregularly divided or slightly pinnate; branches distant, ascending or spreading, slightly flattened, more or less uncinate at the end; *leaves* close, imbricate at base, *falcate-secund, keeled-conduplicate, oblong-lanceolate,* then *gradually narrowed, acuminate-subulate,* 3–5 mm. long, 0.75–1.35 mm. wide; margins plane or slightly revolute, entire in lower ⅔ or ¾, denticulate toward the apices; *costa usually excurrent, frequently percurrent or almost so;* median leaf cells linear-attenuate, 5–6.5 μ wide, 10–20 : 1; basal cells golden-yellow; alar group inconspicuous; perichaetium very long, narrowly cylindric; *inner perichaetial leaves ecostate, strap-shaped, long acuminate,* entire or slightly denticulate toward

the apex, clasping at the base, *spirally twisted around the seta; seta* erect, reddish, *usually passing at considerable length beyond the perichaetial leaves*, 5–15 mm. long; *capsule erect*, oval, oval-oblong, or cylindric, rounded at the base, occasionally contracted beneath mouth when dry, yellowish or rust-brown, sometimes darkening with age, 1.25–2 mm. long, 0.50–0.90 mm. in diameter; operculum conical-acuminate, commonly as long as the urn, obliquely beaked; calyptra longer than the capsule, base closely clasping the seta; peristome reddish or yellowish-orange, teeth linear, about 0.5 mm. long, strongly papillose, with articulations rather close; *trellis perfect*, rust-brown, muricate, cilia longer than the teeth, about 0.6 mm. in length; spores smooth or minutely papillose, 10–14 μ in diameter, ripe in summer.

Type locality, northern Europe.

Illustrations:—Hedwig, Musc. Frond. **3**: *pl. 24;* Myrin, l. c. *pl. 6;* Bryol. Eur. *pl. 433;* Engler & Prantl (Ed. 2) **11**: *fig. 478;* Limpricht, pp. 675 & 676; Husnot, Musc. Gall. *pl. 81; Pl. 79.*

Exsiccati:—*Sullivant & Lesquereux*, Musc. Bor. Am. (Ed. 1) 229b, New Eng.; (Ed. 2) 343; *Grout*, N. Am. Musc. Pl. 396, Conn.

I have examined specimens collected in sloughs, swamps, streams, and lakes, in Labrador, Ontario and Alberta, Canada, and in the United States in Washington, Oregon, Minnesota, New Hampshire, and Maine. The range of this species in North America is Canada and northern United States. Also in Northern Europe and Northern Asia.

D. falcatum is distinguished from other species of *Dichelyma* by leaves oblong-lanceolate, gradually narrowed into acuminate-subulate apices, falcate-secund, costa usually excurrent, occasionally percurrent, inner perichaetial leaves strap-shaped, very long acuminate, spirally twisted around the seta, capsule surpassing the perichaetium, and trellis perfect. Sterile plants of *D. falcatum* resemble those of *Drepanocladus* but are distinguished by the absence of enlarged alar cells.

2. Dichelyma uncinatum Mitt. in Journ. Linn. Soc. **8**: 44. 1864.

Dichelyma capillaceum C. Müll. ms. in Musc. Roell., not Bryol. Eur., (according to Cardot).
Dichelyma cylindricarpum Aust. in Bot. Gaz. **2**: 111. 1877.
Dichelyma uncinatum Mitt., var. *cylindricarpum* (Aust.) Card. in Mon. Font. 139. 1892.

Plants yellowish-green and frequently glossy above, brownish or blackish at the base; stems more or less regularly pinnate, 6–12 cm. long, denuded below; branches distant, spreading, uncinate at the end; *leaves* rather close, *tristichous, falcate-secund, keeled-conduplicate, oblong-lanceolate*, then *gradually narrowed and long-subulate*, 4–5 mm. long, 0.50–0.65 mm. wide, *margins plane or slightly revolute toward the middle*, denticulate or sinuolate in the upper one-third or one-half, sometimes entire; *costa long-excurrent*, frequently denticulate at the apex only; median leaf cells linear-attenuate, 5–6.5 μ wide, 12–20 : 1; alar cells indistinct; perichaetium narrowly elongate-cylindric; *inner perichaetial leaves linear, rather long-acuminate*, entire or subdenticulate toward the apex, *sheathing, convolute, not twisted or only slightly so;* seta reddish, 4–6 mm. long, frequently up to 12 mm. in length; *capsule erect, extending to the apices of the perichaetial leaves or surpassing them*, small, oblong-subcylindric, oval-oblong or cylindric, brownish to yellowish, sometimes slightly curved, rounded or more or less attenuate at the base, sometimes slightly contracted beneath the mouth and wrinkled when dry, 1.25–1.50 mm. long, occasionally 2 mm. in length, 0.50–0.65 mm. in diameter; operculum conic-acuminate; according to Mitten, calyptra not adhering to the seta by the base; peristome teeth orange, linear-subulate, almost as long as the trellis, papillose, with 12–18 articulations; *trellis* orange-brownish, *perfect*, strongly papillose, exceeding outer peristome by about one-fifth of length of teeth; spores finely muricate.

Type locality, Fort Colville, British Columbia, Canada; collected by Lyall.

Illustrations:—Mitten, Journ. Linn. Soc. **8**: *pl. 8; Pl. 79.*

Exsiccati:—*Lyall*, near 49th parallel of Lat., Oregon Boundary Commission 1858–1859, in Farlow Herb.; from Fort Colville to Rocky Mts., 1861, in Farlow Herb.; *Grout*, N. Am. Musc. Pl. 92, B. C., 92A, Wash.; *Piper*, 103, Wash.; *Foster*, 398, Wash.; *Howell*, Ore. in 1886; *Holzinger & Blake*, Mosses of northwestern Minn. 43; *Leiberg*, Mosses of Kootenai Co., Idaho, 81; *Macoun*, Canadian Musci 194, 211, 234, 607, B. C.; 761, along L. Superior, Ont.; 213, Vancouver Id.

In mountain streams and basins, lakes, rivers, and ponds, in northern United States and southern Canada, especially in the western portions.

D. uncinatum is distinguished from *D. falcatum* by habit more slender, leaves more setaceous because of the excurrent costa which is usually more or less smooth beyond the denticulate or sinuolate margins, and frequently denticulate only at the apex, perichaetial leaves not twisted, and inner peristome exceeds the external teeth by about one-fifth of their length.

I am unable to find any constant distinguishing characteristics by which *D. uncinatum* Mitt. and var. *cylindricarpum* (Aust.) Card. can be separated when not in fruit. The leaves and leaf apices vary but leaves

on the same plants show the same variations in size, width of apices, denticulation, etc. Although the setae in the variety are usually much longer than those of the species, several sporophytes were found in which the setae of the variety were about the length of those in the species. Cardot, in Mon. Font., p. 140, states that it is impossible to separate the two definitely and that the seta length is a variable factor in most mosses and is probably subject to rather great variation in *Dichelyma* also. The seta length and capsule size given for var. *cylindricarpum* are included in the description of *D. uncinatum* and the exsiccati of the variety and the species have been combined.

3. DICHELYMA CAPILLACEUM [Dill.] Bryol. Eur. **5**: fasc. 31, Suppl. 1. 1846, not Myrin.

Dichelyma capillaceum β subulifolium Bryol. Eur. **5**: 8. 1842.
Neckera capillacea C. Müll. Syn. **2**: 144. 1850.
Dichelyma pallescens Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 346, 1865, not Bryol. Eur., according to Cardot.
Dichelyma capillaceum BS., var. *elongatum* Kindb. in Macoun, Cat. Can. Pl. **6**: 160. 1892.

Plants slender and rather delicate, more or less glossy, yellowish-green or brownish above, dull green or blackish below; stems slender, 5–15 cm. long, more or less irregularly pinnate, sometimes denuded below; branches distant, spreading, distichous or homotropous, slightly flattened, generally curved at the end, sometimes slightly falcate; leaves rather close to distant, occasionally up to 1 mm. apart, *commonly erect-spreading or subsecund, the younger frequently falcate-secund, keeled-conduplicate, oblong-lanceolate, gradually narrowed, long subulate;* 5–7 mm. long, 0.50–0.65 mm. wide; margins plane or slightly revolute toward the middle, entire or subdenticulate above; *costa long-excurrent*, denticulate or entire at the end; median leaf cells linear-attenuate, 6–7 μ wide, 10–20 : 1; alar cells indistinct; perichaetium elongate-cylindric; *inner perichaetial leaves acuminate*, entire or subdenticulate toward the apices, *clasping, convolute, spirally twisted, surpassing the capsule;* seta 3–4 mm. long, completely hidden in the perichaetial leaves; *capsule at first immersed in the perichaetium, later laterally emergent, erect or oblique*, oval or oval-oblong, yellowish, rounded at the base, 1–1.5 mm. long, 0.50–0.65 mm. in diameter; operculum convex-conic, beak oblique; calyptra large, covering the entire capsule; peristome orange; teeth linear, strongly papillose, with 10–15 articulations; *cilia* well-developed, articulate, strongly papillose, *much longer than the teeth, free almost their entire length, united at the apex with 2 or 3 transverse strands;* spores smooth or finely muricate, 10–15 μ in diameter, ripe in summer.

Type locality, Europe.

ILLUSTRATIONS:—Bryol. Eur. *pl. 436;* Grout, M.H.M. *fig. 219; Pl. 79.*
EXSICCATI:—*Drumm.* Musc. Am. 234 in part; *Sull.* Musc. Allegh. 151; *Sull. & Lesq.*, Musc. Bor. Am. (Ed. 2) 345 & 346; *Austin*, Musc. Appal. 252; *Renauld & Cardot*, Musc. Am. Sept. Exsicc. 187, Conn.; Grout, N. Am. Musc. Pl. 46, Vt.; 344, Quebec.

In streams, rivers, pools, ponds, and swamps in eastern United States and Canada, from New Brunswick and Ontario southward to North Carolina and Tennessee. Also in Europe.

In sterile condition, *D. capillaceum* and *D. uncinatum* resemble each other rather closely. *D. capillaceum* is more slender and delicate, leaves commonly longer subulate, erect-spreading, slightly secund, the younger falcate-secund. When fertile, *D. capillaceum* is characterized by inner perichaetial leaves acuminate, clasping, convolute, spirally twisted, surpassing the capsule; and trellis imperfect.

No material of *D. capillaceum* Bryol. Eur., var. *elongatum* Kindb. has been available. Kindberg's description "stems more elongate, branches more distant, the leaf base longer than the excurrent part of the costa" indicates that it may be a form of *D. capillaceum*. Since these characteristics in aquatic mosses are subject to more or less change, I prefer to consider *D. capillaceum*, var. *elongatum* as a synonym of *D. capillaceum*.

4. DICHELYMA PALLESCENS Bryol. Eur. **5**: fasc. 31, Suppl. 1. 1846.

Dichelyma capillaceum Myr. l. c.
Fontinalis capillacea Hook. & Wils. in Drumm. Musci Amer. 234 in part, 1841, not Dicks., according to Cardot.
Neckera leucoclada C. Müll. Syn. **2**: 144. 1851.
Dichelyma Novae-Brunsviciae Kindb. in litt., according to Cardot.
Dichelyma obtusulum Kindb. in Macoun Cat. Can. Pl. **6**: 159. 1892.

Plants yellowish, slightly glossy, or of a pale and dull green; stems very slender, 3–8 cm. long, irregularly and subpinnately branched, generally denuded at the base; branches distant, spreading, slightly flattened, more or less curved at the end; *leaves* rather close or only slightly distant, *secund, slightly falcate, keeled-conduplicate, oblong-lanceolate, gradually narrowed, acuminate, acute, subobtuse, or obtuse*, 3–4 mm. long,

0.65 mm. wide, margins plane, denticulate toward the apex, rarely subentire, *costa percurrent or subpercurrent;* median leaf cells linear-rhombic, 6.5–8.5 μ wide, 8–15 : 1; alar cells indistinct; perichaetium narrowly elongate-cylindric; *inner perichaetial leaves linear, long-acuminate, entire, clasping, convolute, spirally twisted;* seta 4–6 mm. long, entirely hidden in the perichaetial leaves; *capsule small, emerging laterally from the perichaetium or slightly surpassing it,* erect or oblique, oval-oblong or subcylindric, rounded or slightly attenuate at the base, yellowish, 0.65–1.25 mm. long, 0.35–0.50 mm. in diameter; operculum conic-acuminate; *calyptra large, the base clasping the seta;* peristome orange; teeth linear, finely papillose, with 8–12 articulations; *cilia* narrow, articulate, finely papillose, *longer than the teeth, entirely free or united at the apex with 2 or 3 transverse strands;* spores smooth, 10–13.5 μ in diameter.

Type locality, North America.

Illustrations:—Bryol. Eur. **5:** *pl. 435;* Grout, M.H.M. *fig. 220;* Jennings, Mosses W. Pa. *pl. 31; Pl. 79.*

Exsiccati:—*Drumm.* Musc. Am. 234 in part; *Austin,* Musci Appal. Suppl. 1, 525; *Fernald,* Flora of Maine 139; *Merrill,* E. D., Flora of Maine 117; *Burnett,* 2768, N. Y.; *Grout,* N. Am. Musc. Pl. 121, 121a, N. Y.; *Fowler,* 534, 609, N. B.; *Macoun,* Canadian Mosses 210, 235, Ont.

Along creeks and around ponds, New Brunswick to Minnesota and Pennsylvania. According to Cardot, in Rocky Mts., reported by Drummond.

D. pallescens is characterized by leaves secund, slightly falcate, keeled-conduplicate, oblong-lanceolate, gradually narrowed, acuminate, acute to obtuse, costa percurrent or subpercurrent, inner perichaetial leaves linear, long-acuminate, convolute, spirally twisted, capsule emerging laterally from perichaetium or slightly surpassing it, and cilia longer than teeth, and entirely free or united at apex with 2 or 3 transverse strands. When in sterile condition, *D. pallescens* is distinguished from other species in *Dichelyma* by leaves not acuminate-subulate, and only slightly falcate.

Excluded Species.

I consider *Dichelyma brevinerve* Kindb., Rev. Bryol. **4:** 99. 1909, *Dichelyma Swartzii* Lindb. in Hartm. Skand. Fl. (Ed. 8) 353, 1861, *D. longinerve* Kindb. in Bull. Torr. Bot. Club **16:** 97, 1889, and, according to Cardot, *D. californicum* Aust. in herb. as belonging to *Drepanocladus.* I have excluded these from the genus *Dichelyma* because the leaves are not keeled-conduplicate and the alar cells are enlarged and distant, forming more or less apparent auricles.

(It was not practicable to examine all numbers of Sullivant and Lesquereux, Musc. Bor. Am. (Ed. 2), or Sullivant, Musc. Allegh., and none of either set of Drummond, Musc. Am. S. States; hence Cardot's statements concerning the different unexamined species in these sets have been accepted.)

ADDITIONS

Supplementary Key to Mosses in Volume Three

1. Leaves papillose ..... 2.
   Leaves not papillose ..... 15.
2. Papillae formed by projecting cell angles ..... *Hypnaceae* sp. and *Pterogonium*.
   Papillae over cell lumen* ..... 3.
3. Leaves with a strong spreading double costa reaching beyond middle of leaf ..... *Callicostella*.
   Costa single, or short, or lacking ..... 4.
4. Costa short often faint and double or lacking ..... 5.
   Costa well developed, mostly single and reaching leaf middle ..... 6.
5. Leaf cells rarely over 3 : 1, often shorter ..... *Leskeaceae* and *Schwetschkeopsis*.
   Leaf cells more than 3 : 1 ..... *Taxithelium*.
6. Leaf cells with a single papilla at back ..... 7.
   Leaf cells with two or more papillae at back on some or all ..... 11.
7. Papillae very large and sharp ..... 8.
   Papillae relatively low and small ..... 9.
8. Plants large, dendroid, circinate when dry, dark green ..... *Dendroalsia*.
   Plants smaller, light green to glaucous ..... *Thelia*.
9. Leaves somewhat complanate; plants subtropical ..... *Stereophyllum*.
   Leaves not at all complanate ..... 10.
10. Capsules immersed ..... *Cryphaea*.
    Capsules on a long seta ..... *Leskeaceae*.
11. Leaves strongly auriculate ..... 12.
    Leaves not auriculate ..... 13.
12. Auricles fimbriate-papillose ..... *Anomodon Rugelii*.
    Auricles scarcely papillose ..... *Tricholepis*.
13. Leaf cells less than 5 : 1, mostly dense and subopaque ..... *Leskeaceae*.
    Leaf cells more than 5 : 1, not dense or opaque ..... 14.
14. Margins plane ..... *Barbella*.
    Margins revolute ..... *Leucodontopsis*.
15. Costa strong, single, reaching leaf middle or beyond ..... 16.
    Costa not as above ..... 25.
16. Leaves strongly complanate ..... 17.
    Leaves not complanate ..... 18.
17. Plants with small differentiated under leaves (amphigastra) ..... *Hypopterygium*.
    Plants without amphigastra ..... *Porothamnium* and *Neckeraceae*.
18. Leaves squarrose ..... *Campylium*, *Jaegerinopsis* and *Hylocomieae*.
    Leaves not squarrose ..... 19.
19. Median leaf cells 4 : 1 or less ..... 20.
    Median leaf cells 5–20 : 1 ..... 23.
20. Plants minute; leaves soft and delicate; leaf cells thin-walled ..... *Fabroniaceae*.
    Plants small to large; leaves more rigid when dry; leaf cells mostly thick-walled ..... 21.
21. Costa strong, nearly reaching apex, markedly flexuous ..... *Herpetineurum*.
    Costa various but not flexuous ..... 22.
22. Capsules exserted on a long seta ..... *Leskeaceae* and *Hypnaceae*.
    Capsules on a short seta, immersed to shortly exserted ..... *Cryphaeaceae* and *Leucodontaceae*.
23. Plants rarely fruiting, subtropical, confined to Florida and the Gulf coast ..... *Meteoriopsis*, *Pireella* and *Pseudocryphaea*.
    Plants found in all parts of N. America ..... 24.

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*See also *Leucodon julaceus* and *Pseudocryphaea*.

24.	Aquatic; perichaetial leaves longer than the seta	*Brachelyma* and *Dichelyma* (except *Dichelyma* sp.)
	Rarely aquatic; seta much longer than the perichaetial leaves	*Hypnaceae.*
25.	Costa double and strong, reaching leaf middle	*Hookeriaceae.*
	Costa short to lacking	26.
26.	Leaves strongly complanate	27.
	Leaves not complanate	28.
27.	Leaves soft and thin; leaf cells 50–60 μ wide	*Hookeria.*
	Leaves mostly of firmer texture; leaf cells much narrower	*Neckera* and *Hypnaceae* species
28.	Aquatic, long and floating; capsules immersed	*Fontinalis.*
	Rarely aquatic, if so only a few centimeters in length	29.
29.	Capsules exserted on a long seta	*Hypnaceae.*
	Capsules immersed	*Leptodon* species.

BESTIA OCCIDENTALIS (Sull. & Lesq.) **n. comb.**

Hypnum occidentale Sull. & Lesq. Sull. Icones Musc. Suppl. 105. *pl. 81.* 1874.
Isothecium occidentale Williams, Bryol. **29**: 48. 1926.
Pseudoleskeopsis occidentalis Grout, Ck. List 25. 1929.

Plants in rather thin, densely interwoven mats, light to yellowish green, having much the appearance of a *Heterocladium* or a slender *B. Breweriana;* stems much divided, 2–4 cm. long, prostrate, filiform, the ultimate divisions more or less pinnately branched with branches of unequal length, which are slender and often attenuate; leaves closely imbricate when dry, erect-spreading when moist; stem leaves oblong-ovate, acute to obtuse, 0.6–0.8 mm. long, somewhat concave, not decurrent; margins plane and more or less serrulate above; costa simple, reaching to about the leaf middle; median cells oblong to elliptical, 7–8 μ wide, about 2 : 1, often subhexagonal near apex, gradually but slightly elongated at middle base, a considerable area of subquadrate angular cells; the marginal cells are smaller than the median; leaves of ultimate branches and branchlets smaller, more serrate and more nearly oblong, more rounded-obtuse; perichaetial leaves sheathing at base, the inner with spreading tips. Dioicous; seta smooth, ± 1.5 cm. long; capsule oblong-ovoid to oblong-cylindric, somewhat inclined; operculum long-conic to subrostrate; peristome perfect hypnaceous with two well developed cilia; annulus lacking. Type locality, Oregon, Hall.

ILLUSTRATIONS:—Sull. l. c.; *Pl. 71.*
EXSICCATI:—Grout, N. Am. Musc. Pl. 252; Allen, Mosses Cascade Mts. 90b (at least in the author's set). According to Dr. Best in his Monograph on *Heterocladium* (Bull. Torr. Bot. Club **28**: 129), this species is often associated with *H. heteroptoides* and Allen's 90b (issued as *H. heteropterum*, Det. Best) is likely to be mixed. On moist rocks, especially in crevices; Oregon, Washington, and Vancouver Island.
This species was overlooked in the Lesq. & James Manual and besides the synonymy given above it has been put in *Thuidium*, *Heterocladium* and *Pseudoleskella* by Kindb. Brotherus has apparently overlooked it. (See Ed. 2 of Engler-Prantl.)

BRYHNIA HULTENII Bartram. **n. sp.**

"Dioica, gracilis, pallide lutescenti-viridibus, nitidis. Caulis repens, parce radiculosus, subpinnatim ramosus, ramis ad 15 mm. longis, attenuatis. Folia caulina ad 1.1 mm. longa, longe decurrentia, plicata, e basi cordata late ovata, obtusa vel truncata, minute apiculata; marginibus erectis, superne inequaliter serratis, nervo sat tenui, ad medium folii evanido; cellulis anguste rhomboideis, papillose exstantibus, alaribus rectangularibus, hyalinis. Folia ramea minora, acuta vel acuminata. Bractae perichaetii e basi vaginante sensim in acumen denticulatum attenuatae. Caetera ignota." (Bartram.)

Plants light yellow-green, irregularly divided, subpinnately branching, stems 3–4 cm. long, apparently ascending, stem leaves shortly deltoid-ovate, about 1 mm. long by 0.8 mm. wide, abruptly narrowed to the insertion, obtuse or usually short-apiculate, very concave and subcucullate at apex, strongly decurrent, finely serrulate all around, faintly costate to about the middle; median leaf cells linear, 6–9 μ wide, ± 5–8 : 1, marginal and apical cells shorter; at the rounded basal angles a large group of small rounded rather irregular cells, below these a group of very large inflated cells, reaching 35 x 90 μ, hyaline or somewhat colored, reaching half way to the costa and long decurrent on the stem; branch leaves ovate, acuminate, serrulate, with shorter leaf cells, papillose at back by projecting cell-angles.

Ill. MF I Pl. 128B

Type from Kodiak Island, Alaska, 4-27-1932, Eric Hultén No. 5135; also from Sitkalidak Id., Port Hobron, Sept. 5, 1931, W. J. Eyerdam no. 36c.

The pale yellowish color, the short, faint costa, the rounded, apiculate stem leaves and the short pointed branch leaves seem to adequately distinguish this species from any of the forms of *Bryhnia Nova-Angliae* (Sull. & Lesq.) and from any of the Japanese species of *Bryhnia* which are available for comparsion. Type in herb. Bartram and herb. A. J. G.

No antheridia present. Except for papillae at back of branch leaves this would certainly be placed in *Calliergon*.

RHYNCHOSTEGIELLA GEORGIANA Dixon & Grout, Bryol. **33**: 27. *pl. 4.* 1930.

Plants slender, irregularly branching, loosely sprawling over the substratum, yellowish green, apparently somewhat complanate-foliate; stems 5–10 mm. long; leaves spreading at an angle of about 60° when dry, more widely spreading when moist, shrunken and more strongly concave when dry, narrowly lanceolate, broadest about ¼ the length from the base, gradually and evenly narrowed to the slender-pointed apex, 1.5–2 mm. long by about 1/10 as broad, with plane entire margins; leaf cells narrowly linear-rhomboidal, median 70–100 μ long by 6–9 μ wide, shorter and broader near the base; basal rectangular; costa well developed below, vanishing above the middle. Apparently dioicous as sporophytes and antheridia were observed on separate plants; inner perichaetial leaves broader, ovate at base with a stronger costa; seta yellowish reaching 2–2.5 cm. in length, smooth; capsule short-oblong, cernuous and unsymmetric at base, about 1.25 mm. long and more than half as broad, not contracted below its mouth when dry and empty; annulus, operculum and calyptra lacking; peristome perfect, cilia (2) and segments nearly or quite the length of the teeth, upper part of teeth, cilia and segments granulose, and nearly hyaline; stomata few, at the very base of the capsule. *Pl. 80.*

On rotten log in swamp of Ocmulgee R. about two miles below Macon, Bibb Co., Georgia. R. M. Harper, Georgian Plants 1884c. Type in British Museum; cotype in herb. A. J. Grout, com. H. N. Dixon.

"Differs from *R. tenella* (Dicks.) Limpr. in the more robust, *much laxer* growth, distant, ± complanate, widely spreading leaves, longer, fully 1 mm. (there .6–.9 mm.), less finely subulate, quite entire (there usually with a suspicion at least of denticulation); nerve shorter and weaker; cells slightly but appreciably wider, and more pellucid; 6–7 μ wide (there 5–6 μ); and very markedly in the longer seta ± 2 cm. (there about 1 cm., often much shorter)."

"*R. Jaquinii* (Garov.) Limpr. has a slightly nearer approach to it in habit, but in all other characters is at least equally if not more distinct, and has a rough seta."

"*R. curviseta* has a very appreciably wider leaf and wider acumen in proportion to length, margin usually finely denticulate, and short rough seta, except in var. *laeviseta* Nichols & Dix. where the seta, while smooth is much shorter."

"It is more nearly like some Asiatic species; indeed the South Indian *R. leiopoda* Dix. & Varde differs very little except in the much shorter seta." H. N. D.

HYGROAMBLYSTEGIUM MACRONEURON Grout, Bryol. **36**: 1. 1933.

Plants in deep loosely interwoven masses, dark to bright green above, brown and lime imcrusted below; stems 3–5 cm. long, irregularly to subpinnately branching; cortical stem cells small, inside these 2–3 rows of slightly larger thick-walled cells, central strand of a few narrow cells or lacking, the other inner cells large, parencymatous in cross-section, about 30 μ in diameter; leaves from the upper middle region of branches ± 0.5 mm. wide x ± 1.7 mm. long, oblong-lanceolate, obtusely acute at apex, not decurrent, serrulate to the middle or below; costa ⅓ the width of the leaf base, very thick and strong, diffusing and disappearing in the apex, in cross-section elliptical in the leaf middle and composed of uniform thick-walled cells except the somewhat smaller outer layer, near the apex the costa often forks, and often one or more slender branches are given off from the lower portion; lower stem leaves shorter and more acute; median leaf cells 30–40 x ± 6 μ, oblong to linear, flexuose; basal shorter, alar not differentiated. Archegonia and antheridia not found. *Pl. 80.*

Type from near Junction, Texas, in springs along the banks of the Llano River, Jan. 1, 1932. Comm. Miss Eula Whitehouse.

Here we have another case of tremendously thickened costa in the Hypnaceae associated with lime in solution.

The generic affinities of this plant are uncertain until sporophytes are found. It is placed in *Hygroamblystegium* because of the branched costa and elongated leaf cells.

SCIAROMIUM FRYEI Williams, Bryol. **35**: 52. 1933.

Flowers and fruit unknown: plants up to 7 cm. or more high, with wiry stems, bearing irregular, flexuous branches; the stems in cross section oval, about .4 mm. by .3 mm. in diameter, showing a small central strand and thick-walled outer cells in 3 or 4 rows; leaves rather distant, flexuous-spreading when dry, those of stem up to 3.5 mm. long, rather broadly lanceolate, the margins often serrulate nearly all round, of a single thickness of cells and in places only 1 cell wide or entirely lacking, just within which is a broad band of elongate cells, 2 layers in thickness, extending from near the base to the short-excurrent, stout costa; upper branch leaves very similar to those of stem but smaller; leaf-cells small, smooth, irregular and angular, the median 6–8 μ wide and up to 16 μ long, quite similar to near base, the larger basal cells extending across leaf in about 2 rows. *Pl. 80.*

Type collected in more or less wet pasture land at Cape Arago, Oregon, Aug. 8, 1922 by T. C. Frye.

HYLOCOMIUM SPLENDENS (Hedw.) Bry. Eur. var. **tenue** Sharp. Bryol. **36**: 21. 1933.

Stems slender, attenuate, sparingly bipinnately branched; stem leaves similar to the branch leaves; paraphyllia rare. Found growing in mats closely adpressed to the perpendicular surfaces of rocks.

TYPE:—On siliceous rocks, Roaring Fork Creek, Mt. Le Conte, Sevier Co., Tennessee. alt. 5500 ft. May 8, 1932. The type material is deposited in the herbarium of The University of Tennessee.

This variety was also found on a similar substrate, Rainbow Falls, Mt. Le Conte, Sevier Co., Tennessee. 4000 ft. Sept. 29, 1930. This collection is to be found in The University of Tennessee herbarium.

These plants have somewhat the gross appearance of *Hygrohypnum micans* (Wils.) Broth. but are of a darker copper color.

CORRECTIONS

CORRECTED KEY TO THE SUBFAMILIES OF HYPNACEAE p. 3.

1. Costa strong and extending to the middle of the leaf or beyond, usually single. (Exceptions in *Hylocomium* and *Campylium*) ..... 4.
   Costa short and double or lacking ..... 2.
2. Capsules erect and symmetrical, or nearly so; cilia rudimentary or lacking ..... *Entodonteae.*
   Capsules more or less cernuous, unsymmetrical ..... 3.
3. Plants complanate-foliate (exc. *Plagiothecium striatellum* and *P. latebricola*); leaves seldom secund ..... *Plagiothecieae.*
   Plants not complanate-foliate, leaves usually more or less secund ..... *Hypneae.*
4. Plants large, secondary stems dendroid from creeping or stoloniferous primary stems ... 5.
   Plants smaller, not dendroid ..... 6.
5. Capsules erect and symmetrical (Exc. *Girgensohnia*); peristome without cilia ..... *Climacieae.*
   Capsules curved, peristome perfect ..... *Porotricheae.*
6. Plants complanate-foliate ..... *Stereophylleae.*
   Plants not complanate-foliate ..... 7.
7. Capsules ovoid, short, thick and unsymmetric with few exceptions, often little contracted under the mouth when dry; stem and branch leaves often quite different .. 8.
   Capsules longer, arcuate-cylindric as a rule, usually more contracted under the mouth when dry ..... *Amblystegieae.*
8. Costa single and usually reaching well beyond middle of leaf; seta often rough; paraphyllia lacking ..... *Brachythecieae.*
   Costa frequently double, often short; paraphyllia large and abundant in many species; seta smooth ..... *Hylocomieae.*

p. 9, line 2, for Vancouver, read Vancouver Island.

p. 19. Substitute EURHYNCHIUM SUBSTRIGOSUM Kindb. for *E. fallax* (R. & C.) Grout, as it has six years priority. Type seen.

p. 22, line 17, Holzinger's number is 330, not 530.

p. 23. The range of *Eurhynchium serrulatum*, eastern U. S., Vermont to Texas, west to Kansas.

p. 24, line 23, read CIRRIPHYLLUM Grout.

p. 25. *Cirriphyllum cirrosum coloradense* at Kaniak Butte, Whitman Co., Washington, (Geo. N. Jones).

p. 29, line 1. *Brachythecium* was published in fasc. 52–54 of the Bry. Eur. *Brachythecium glareosum* does not appear in the key. It will key out to 13. It is a larger species with more plicate leaves than the other species under that number.

p. 32. Jennings, Mosses W. Pennsylvania *pl. 50*, has a good illustration of *Brachythecium flexicaule*.

p. 38, line 10 from bottom, read *B. mirabundum*, also 199 for 194.

p. 39, line 31, for 1926, read 1896.

p. 41, line 20 from the bottom read C. V. Piper. Also after *Brachythecium rivulare* insert as synonym *Hypnum vagans* Drumm. Musc. Am. 166 (Specimen in the Canadian National Museum studied).

p. 43. The description of *Brachythecium plumosum* states "quadrate alar cells few." They are occasionally rather numerous.

p. 45, 18th line from bottom, read H. N. Dixon.

p. 48. *Brachythecium collinum* has been collected at East Rainy Butte, N. Dakota and El Paso, Texas.

p. 51 before "SCLEROPODIUM" insert

Brachythecium laxirete Kindb. Rev. Bryol. **36**: 97. 1909. apparently only an unimportant form of *B. rutabulum*.

Brachythecium papillipes Kindb. l. c. Doubtful, possibly a depauperate form of *B. rutabulum* with leaves more decurrent than usual.

Brachythecium pseudo-chlopterum Kindb. Ottawa Nat. **23**: 839. 1909. Almost certainly a form of *B. reflexum*. Described as "diecious" but non-fruiting plants will scarcely determine this accurately in the hands of a Kindberg.

No specimens of these 3 species (?) have been seen by the author.

p. 56. For *Camptothecium lutescens* (Huds.) Br. & Sch., read *C. lutescens* (Hedw.) Br. & Sch. and add *Hypnum lutescens* Hedw. Sp. Musc. 274. 1801.

p. 59, line 1 of the Key, read *Nuttallii*, not *Nutallii*.

p. 60, in three places near bottom of page, *hamatidens* Kindb. is misspelled.

Description of *Pl. 4*, read *Eurhynchium Rappii*, not *Rapii*.

Description of *Pl. 8*, read in line 1, B, not C.

Description of *Pl. 10*, fifth line, read *subasperrimum*, not *supasperrimum*.

Description of *Pl. 14*, read *Homalothecium nevadense*, instead of *C. Nevadense*.

p. 74, line 20, read forma BREVIFOLIUM Boulay, Musc. Fr. 73. 1884. This is not the var. *brevifolium* of R. & C. Bot. Gaz. **30**: 22. 1900. The latter seems to be an unimportant variation. In line 23 in parenthesis read (see Fig. 175, M.H.M.).

p. 77. Add at bottom of page.

Var. IRRIGATUM (Zett.) Broth.

Hypnum irrigatum Zett. Musc. Pyren. in K. Svenska Vet.-Akad. Handl. **5**: (no. 10) p. 48. 1865.

Hypnum Vallis-Clausae Brid. Sp. Musc. **2**: 238.

Very robust, 12–20 cm. high, dark- or brownish-green; stems irregularly divided, sparingly branched; stem leaves straight or falcate, little excavate at base, scarcely concave, ovate-lanceolate, gradually acuminate, plicate, nearly entire; costa stout, excurrent or fused with the apex.

This is to *C. commutatum* what var. *spinifolium* is to *Hygroamblystegium irriguum*. It is distinguished from the latter by the abundant paraphyllia and plicate leaves. Mt. Timpanogos, Utah, alt. 6500 ft. (Seville Flowers).

p. 77. Third line at top of page, read var. ACICULINUM (C. M. & Kindb.) **n. comb.**

Hypnum filicinum var. *aciculinum* C. M. & Kindb. Cat. Can. Pl. **6**: 241. 1892.

p. 78. *Cratoneuron papillosum* was already published for another species from Japan—*C. papillosum* Warnst. Hedwigia **57**: 123. 1915. Loeske first called my attention to this. For *C. papillosum* Grout substitute *Cratoneuron Williamsii* **nomen nov.** in honor of R. S. Williams, who has so often assisted me.

p. 85. The full citation for *Hypnum pseudocomplexum* Kindb. is Rev. Bryol. **22**: 85. 1895.

p. 89. The type of *Hygrohypnum pseudomontanum* Kindb. has been seen. Another specimen from Newfoundland was found in the Kindberg herbarium.

p. 93. Under *Hygrohypnum dilatatum* add, a specimen from Steven's Pass region, Cascade Mountains, Washington, on rock, Coll. J. M. Grant, August, 1929, has been identified by Loeske as *H. alpinum*

(Schimp.) Loeske. It has no cilia in the peristome and is rather softer than usual, otherwise it seems good *H. dilatatum.*

p. 100. Other synonyms of *Calliergon turgescens* are *C. lonchopus* Kindb. Rev. Bryol. 32: 37. 1895. *C. subturgescens* Kindb. Ottawa Nat. 23: 137. 1909.

Types seen in both cases. The latter is a form with the costa lacking or nearly so.

p. 102, line before the key, read *cuspidata* for *cuspidatum.*

p. 129. *Hypnum arcuatum* Lindb. is antedated by *Hypnum arcuatum* Hedw. Sp. Musc. 245. *pl. 62.* 1801, later known as *Hypnodendrum arcuatum* (Hedw.) Mitt., from Australia. Our plant should accordingly retain the name HYPNUM PATIENTIAE Lindb.

p. 145. In first line of "4" in the key read *Selwynii* for *Schimperi.*

p. 153, lines 7, 8 and 9 from the top, read *V. vesicularis* for *V. vesiculare* and *vesicularia.*

p. 157, line 25, read Dixon & Jam., Handb. Brit. Mosses (Ed. 1) 436. 1896 in place of **n. comb.**

p. 163, line ten from the bottom, read gemmiform, for gemmiforn.

INDEX TO VOLUME III

Acrocladium cuspidatum, 102.
Alsia, *226*.
abietina, 225.
californica, 226.
longipes, 10.
Macounii, 225.
Amblystegieae, 63.
Amblystegiella, 142.
adnata, 141.
confervoides, 143.
f. brevifolia, 144.
minutissima, 144.
Sprucei, 144.
subtilis, 143.
Amblystegium, *63*, 68.
adnatum, 141.
ambiguum, 67.
americanum, 71.
brachyphyllum, 65.
brevipes, 66.
compactum, 71.
confervoides, 143.
curvipes, 68.
dissitifolium, 71.
Ehlei, 88.
filicinum, 76.
floridanum, 66.
fluviatile, 74.
glaucum, 77.
Holzingeri, 71, 92.
irriguum, 72.
Juratzkanum, 69, *79*.
v. giganteum, 69.
Kneiffii, 110.
Kochii, 67.
laxirete, 64.
Lescurii, 75.
minutissimum, 144.
montanae, 194.
noterophilum, 74.
polygamum, 83.
pseudo-confervoides, 143.
radicale, 84.
riparium, 64.
v. *abbreviatum*, 65.
v. *floridanum*, 66.
v. *trichopodium*, 67.
serpens, 69.
v. beringianum, 69.
v. *giganteum*, 69.
v. *irriguum*, 72.
v. tenue, 69.
v. *radicale parvulum*, 70.
serratum, 71.
Sprucei, 144.
subcompactum, 71.
subtile, 143.
tundrae, 114.
vacillans, 67.
varium, 70.
v. alaskanum, 71.
v. lancifolium, 71.
f. laxum, 70.
v. ovatum, 71.
v. parvulum, 70.
Anacamptodon, 230.
splachnoides, 230.
v. Tayloriae, 231
Anisodon perpusillus, 231.
Anomodon, 201.
apiculatus, 203.
attenuatus, 203.
californicus, 201.
devolutus, 201.
flagelligerus, 201.
heteroideus, 194.
minor, 202.
obtusifolius, 202.
rigidulus, 194.
rostratus, 204.
Rugelii, 203.
subrigidulus. 195.
tectorum, 195.
toccoae, 201.
tristis, 204.
viticulosus, 202.
v. macrophyllus, 202.
Anomodonteae, 201.
Antitrichia, 224.
californica, 225.
curtipendula, 224, *225*.
v. gigantea, 224.
pseudo-californica, 226.
tenella, 225.

Barbella, 214.
pendula, 214.
Bestia, 9.
Breweriana, 10.
v. Howei, 10.
v. lutescens, 10.
Holzingeri, 9.
longipes, 10.
occidentalis, 264.
Brachelyma, 257.
robustum, 258.
subulatum, 258.
Brachythecieae, 11.
Brachythecium, 29.
acuminatum, 27.
v. *subalbicans*, 34.
acutum, 32.
albicans, 33.
v. occidentale, 33.
asperrimum, *40*, 39.
beringianum, 38.
Bestii, 45.
biventrosum, 28.
Bolanderi, 49.
calcareum, 50.
campestre, *43*, 32.
cavernosum, 50.
cirrosum, 25.
collinum, 48, 267.
v. idahense, 48.
colpophyllum, 54.
columbico-rutabulum, 39.
cyrtophyllum, 28.
densum, 71.
digastrum, 36.
edentatum, 38.
erythrorrhizon, 49.
v. suberythrorrhizon, 49.
Fitzgeraldi, 50.
flexicaule, 31, 267.
gemmascens, 39.
glaciale, 45.
glareosum, 37, 267.
Hillebrandi, 48.
Holzingeri, 50.
labradoricum, 51.
laetum, 34.
v. *fallax*, 35.
v. *pseudoacuminatum*, 35.
v. *Roellii*, 35.
laevisetum, 31.
lamprochryseum, 40.
v. giganteum, 41.
v. solfatarense, 41.
laxirete, 267,
Leibergii, 47.
leucoglaucum, 38.
mammilligerum, 32.
mirabundum, 38, 267.
micropus, 46.
Mildeanum, 32.
nanopes, 44.
Nelsoni, 42.
Novae-Angliae, 14.
novaeboracense, 42.
oxycladon, *31*, 34.
v. dentatum, 36.
f. falcatum, 36.
pacificum, 40, 45.
papillipes, 267.
pseudochlopterum, 267.
petrophilum, 47.
platycladum, 39.
plumosum, 39, 43.
v. homomallum, 43
v. Pringlei, 43.
v. Roellii, 43.
populeum, *43*, 44.
v. majus, 44.
v. ovatum, 44.
v. rufescens, 44.
Pringlei, 43.
pseudo-albicans, 33.
pseudocollinum, 33.
pseudo-erythrorrhizon, 47.
pseudo-starkei, 50.
pseudovelutinoides, 51.
reflexum, *68*, 44.
pacificum, 45.
rivulare, 41, 267.
v. cataractarum, 42.
v. lamoillense, 42.
v. laxum, 42.
v. *tenue*, 42.
Roellii, 43.
Roteanum, 34.
rutabuliforme, 43.
rutabulum, 38.
v. flavescens, 39.
v. turgescens, 39.

salebrosum, 31.
v. *cylindricum*, 34.
v. flaccidum, 31.
texanum, 34.
Waghornei, 33.
splendens, *27*, 34.
Starkei, *45*, 46.
spurio-acuminatum, 34.
spurio-rutabulum, 39.
subalbicans, 32.
subasperrimum, 40, 267.
suberythrorrhizon, 47, 49.
subintricatum, 39.
Thedenii, 49.
turgidum, 37.
utahense, 49.
velutinum, 46.
Villardi, 39.
washingtonianum, 41.
Wootonii, 37.
Brotherella, 135, *230*.
*delicatula, 136.
recurvans, 135.
Roellii, 137.
tenuirostris, 136.
Bryhnia, 14.
graminicolor, 15.
v. Holzingeri, 15.
Hultenii, 264.
Novae-Angliae, 14.
v. fontinalis, 15.
Burnettia fabrofolia, 62.
subcapillata, 61.

Callicostella, 207.
incurva, 207.
Merkelii 207.
scabrida, 207.
scabriseta, 207.
Calliergidium, 100.
Bakeri, 101.
plesistramineum, *67*, 101.
pseudostramineum, 101.
v. Hoveyi, 101.
v. plesistramineum, 101.
Calliergon, 95.
cordifolium, 96, *102*.
v. *angustifolium*, 96.
f. intermedium, 96.
cuspidatum, 102.
giganteum, 97.
v. *brevifolium*, 97.
v. cyclophyllotum, 97.
v. dendroides, 98.
v. fluitans, 98.
v. labradorense, 98.
lonchopus, 268.
orbiculari-cordatum, 96.
pseudosarmentosum, 99.
*Richardsoni, 96.
sarmentosum, 98.
v. beringianum, 98.
v. fallaciosum, 99.
v. fontinaloides, 98.
stramineum, 99.
subsarmentosum, 98.
subturgescens, 268.
tananae, 103.
trifarium, 99.
turgescens, 100, 268.
Calliergonella, 102.
cuspidata, 102.
Schreberi, 103.
v. tananae, 103.
Camptothecium, 55.
aeneum, 56.
v. dolosum, 56.
v. robustum, 56, 57.
alsioides, 58.
Amesiae, 57.
arenarium, 57.
aureum, *57*.
lutescens, 56, 267.
v. occidentale, 56.
megaptilum, 58.
v. Fosteri, 59
nevadense, *57*, 267.
nitens, 58.
Nuttallii, 60.
paulinaum, 59.
pinnatifidum, 57.
Campylium, 78.
arcticum, 82.
cordatum, 80.
Cardoti, 81.
chrysophyllum, 82, *112*.
v. brevifolium, 83.
f. intermedium, 83.
v. zemliae, 83.
Halleri, 80.
hispidulum, 79.
v. cordatum, 80.
v. Sommerfeltii, 80.
polygamum, 83.
v. fluitans, 84.
v. *longinerve*, 84.
v. longinerve, 84.
v. minus, 83
pseudocomplexum, 85.
radicale, 84.
stellatum, 81.
v. protensum, 81.
Treleasei, 81.
zemliae, 83.
Campylophyllum Halleri, 80.
Chamberlainia, 27.
acuminata, 27.
v. filiforme, 28.
v. rupincola, 28.
biventrosa, 28.
cyrtophylla, 28.
Chrysobryum micans, 94.
Chrysohypnum arcticum, 82.
polygamum zemliae, 83.
Cirriphyllum, 24, 266.
Boscii, 26.
Brandegei, 25.
cirrosum, 25.
v. coloradense, 25, 267.
piliferum, 26.
Tommasinii, 26.
Claopodium, 180.
Bolanderi, 182.
crispifolium, 181.
leuconeurum, 181.
pellucinerve, 182.
Whippleanum, 180.
v. leuconeurum, 181.
Clasmatodon, 231.
parvulus, 231.
v. rupestris, 231.
Climacieae, 4.
Climacium, 4.
americanum, 5.
v. *Kindbergii*, 5.
dendroides, 5.
Kindbergii, 5.
Cratoneuron, 76.
commutatum, 77, 267.
v. irrigatum, 267.
v. *janzenii*, 78.
v. sulcatum, 77.
decipiens, 78.
falcatum, 78.
filicinum, 76.
v. aciculinum, 77, 267.
papillosum, 78, 267.
Williamsii, 267.
Cryphaeacaeae, 222.
Cryphaea, 222.
filiformis, 223.
glomerata, 221, 223.
v. scabra, 223.
inundata, 258.
nervosa, 223.
pendula, 223.
Ravenelii, 223.
Cryphaeadelphus robustus, 258.
subulatus, 258.
Ctenidium, 134.
diminutivum, 150.
Cyclodictyon, 207.
laetevirens, 207.
varians, 207.
Cylindrothecium, 167.
concinnum, 170.
Demetrii, 168.
Dichelyma, *257*, 259.
brevinerve, 262.
californicum, 262.
capillaceum, *260*, 261.
v. *elongatum*, 261.
v. *subulifolium*, 261.
cylindricarpum, 260.
falcatum, 259.
longinerve, 262.
Novae-Brynsviciae, 261.
obtusulum, 261.
pallescens, 261.
subulatum, 258.
Swartzii, 262.
uncinatum, 260.
v. *cylindricarpum*, 260.
Drummondii, 170.
Montagnei, 170.
repens, 148.

Daltonia nervosa, 223.
Dendroalsia, 225.
abietina, 225.
Drepanocladus, 103.
aduncus, 108.
f. acanthocladus, 110.

f. aquaticus, 109.
f. capillifolius, *84*, 111.
f. filicuspis, 110.
f. gracilescens, 110.
f. intermedius, 110.
v. Kneiffii, 110.
f. paternus, 111.
v. polycarpus, 110.
v. pseudofluitans, 111.
f. pseudosendtneri, 109.
f. pungens, 110.
f. uncus, 111.
badius, 107.
*Berggrenii, 114.
brevifolius, 108.
exannulatus, 113.
v. brachydictyus, 114.
f. falcifolius, 114.
f. obtusus, 114.
f. orthophyllus, 114.
v. Rotae, 114.
f. submersus, 114.
f. submersus pinnatus, 114.
f. tenuis, 114.
f. tundrae, 114.
fluitans, 112.
v. falcatus, 113.
f. gracilis, 113.
f. Jeanbernati, 113.
subf. atlanticus, 113.
f. setiformis, 113.
f. submersus, 113.
*intermedius, 107
lycopodioides, 107.
v. brevifolius, 108.
revolvens, 106.
v. Cossoni, 107.
v. miquelonensis, 107.
*Sendtneri, 111.
f. aristinervis, 112.
f. giganteus, 112.
f. gracilescens, 112.
v. Wilsoni, 112.
uncinatus, 105.
v. plumulosus, 106.
v. symmetricus, 105.
v. polaris, 106.
vernicosus, 106.
Wilsoni, 95, 109.

Ectropothecium, 153.
amphibolum, 153.
caloosiense, 154.
crassicaule, 153.
flavoviride, 152.
rutilans, 152.
vesiculare, 152.
Eleutera, 208.
Douglasii, 210.
jamaicensis, 211.
Menziesii, 211.
ornithopodioides, 210.
pennata, 209.
Entodonteae, 166.
Entodon, 167.
acicularis, 168.
brevisetus, 170.
cladorrhizans, 167.
compressus, 169.
Drummondii, 170.
Macounii, 130.
minutipes, 167.
orthocarpus, 170.
repens, 148.
orthoclados, 149.
seductrix, 168.
v. Demetrii, 168.
v. lanceolatus, 168.
v. minor, 168.
v. tenuis, 169.
Sullivantii, 169.
transylvanicus, 167.
Euplagiothecium, 156.
Eurhynchium, 16.
acutifolium, 20.
Boscii, 26.
Brittoniae, 22.
cirrosum, 25.
colpophyllum, 54.
flagelliforme, 53.
crassinervium, 24.
Dawsonii, 23.
diversifolium, *19*, 20.
fallax, 19, 22.
v. Barnesii, 19.
v. Taylorae, 19.
hians, 16.
labradoricum, 51.
Macounii, 54.
myosuroides, 12.
Novae-Angliae, 14.
oreganum, *20*, 22.
pacificum, 45.
piliferum, 26.
praelongum, 16.
praelongum, 20.
v. Stokesii, 21.
v. californicum, 21.
pseudoserrulatum, 46.
pseudospeciosum, 20.
pseudo-velutinoides, 51.
Rappii, 17, 267.
rusciforme, 22.
semiasperum, 43.
serrulatum, 23, 266.
Stokesii, 21.
stoloniferum, 12.
strigosum, 17, *18*.
v. Barnesii, 19.
v. *diversifolium*, 20.
v. *fallax*, 19.
v. praecox, 18.
v. robustum, 18.
v. scabrisetum, 18.
subscabridum, 15.
substrigosum, 19, 266.
Sullivantii, 15.
v. *Holzingeri*, 15.
Taylorae, 19.
Vaucheri, v. *julaceum*, 25.

Fabroleskea Austinii, 196.
Fabroniaceae, 226.
Fabronia, 227.
Bartramii, 228.
caroliniana, 229.
ciliaris, 227.
v. Bartramii, 228.
v. ovata, 228.
Donnellii, 230.
gymnostoma, 229.
imperfecta, 229.
octoblepharis, 227.
v. *ovata*, 228.
pusilla, 228.
pusilla, 227.
Ravenelii, 229.
Wrightii, 229.
brachyphylla, 231.
v. intermedia, 229.
Fissidens sciuroides, 218.
Fontinalaceae, 233.
Fontinalis, 234.
Allenii, 249.
antipyretica, 235.
var. *ambigua*, 239.
var. *californica*, 236.
var. gigantea, 236.
var. mollis, 237.
var. oreganensis, 237.
v. *patens*, 237.
v. patula, 238.
v. *pseudomollis*, 237.
v. *robusta*, 236.
biformis, 241.
californica, 236.
capillacea, 261.
Cardoti, 246.
chrysophylla, 240.
columbica, 238.
dalecarlica, 245, *253*.
v. gracilescens, 246.
v. Macounii, 246.
Delamarei, 248.
denticulata, 254.
dichelymoides, 256.
disticha, *241*, 242.
v. *tenuior*, 256.
Duriaei, 252.
f. *integrifolia*, 253.
f. *latifolia*, 253.
Eatoni, 253.
falcata, 259.
filiformis, 256.
v. *tenuifolia*, 256.
flaccida, 254.
f. *minor*, 254.
Fosteri, 238.
Frostii, 253.
gigantea, 236.
Holzingeri, 243.
Howei, 246.
Howellii, 240.
hypnoides, 250, *253*.
v. *Duriaei*, 252.
v. *Ravani*, 251.
involuta, 247.
f. angustifolia, 257.
Kindbergii, 239.
f. *gracilior*, 239.
v. *gracilis*, 239.
f. *robustior*, 239.
Langloisii, 257.
Lescurii, 253.

v. ? *cymbifolia*, 247.
v. *gracilescens*, 242.
v. ramosior, 253.
MacMillani, 255.
maritima, 239.
mercediana, 238.
microdonta, 243.
microphylla, 246.
missourica, 243.
mollis, 237.
Nelsoni, 244.
neo-mexicana, 238.
v. *columbica*, 238.
nitida, 251.
v. angustiretis, 252.
Novae-Angliae, 246, *253*.
v. cymbifolia, 247.
v. Delamarei, 248.
v. Grouti, 249.
v. heterophylla, 249.
v. latifolia, 248.
v. Lorenziae, 247.
v. Waghornei, 248.
obscura, 252.
patens, 237.
patula, 238.
Ravani, 251.
Renauldi, 242.
rigens, 237.
squamosa, 245.
v. *dalecarlica*, 245.
v. *Delamarei*, 248.
var. *tenella*, 250.
subbiformis, 239.
subcarinata, 255.
subulata, 258.
Sullivanti, 242.
v. microdonta, 243.
f. viridis, 243.
Sullivantii, 243, 253.
tenella, 252, *253*.
trifaria, 235.
umbachi, 243.
utahensis, 237.
Waghornei, 248.
Forsstroemia, 220.
Ravenelii, 223.
trichomitria, 220.

Girgensohnia, 6.
ruthenica, 6.
Groutia, 225.
Grimmia ornithopodioides, 219.

Habrodon, 231.
perpusillus, 231.
Haplohymenium, 204.
triste, 204.
Harpidium, 103.
fluitans **Berggrenii*, 114.
Helodium, 179.
Blandowii, 179.
paludosum, 180.
v. helodioides, 180.
Herpetineuron, 201.
flagelligerus, 201.
Herpetineurum, 201.
toccoae, 201.
Heterocladium, 182.
aberrans, 183.
dimorphum, 183.
heteropteroides, 184.
v. filescens, 184.
heteropterum, 185, 184.
homoeopterum, 183.
Macounii, 184.
procurrens, 183.
squarrulosum, 183.
v. compactum, 184.
vancouveriense, 185.
Heterophyllum, 137.
Haldanianum, 137.
nemorosum, 138.
pseudo-nemorosum, 124.
Holmgrenia, 171.
acuminata, 173.
chrysea, 171.
diminutiva, 172.
intricata, 172.
stricta, 172.
Homalia, 212.
gracilis, 210.
Jamesii, 212.
Macounii, 212.
Sharpii, 213.
trichomanoides, 212.
Homalotheciella, 61.
fabrofolia, 62.
subcapillata, 61.
Homalothecium, 59.
acuminatum, 27.
Bonplandii, 61.
corticola, 61.
nevadense, 59.
v. subulatum, 60.
Nuttallii, 60, 267.
v. hamatidens, 60, 267.
f. leucodontoides, 60.
v. tenue, 60.
sericeum, 60.
sericeoides, 60.
subcapillatum, 61.
Homomallium, 141.
adnatum, 141.
incurvatum, 142.
loriforme, 142.
mexicanum, 142.
v. latifolium, 142.
Hookeriaceae, 206.
Hookeria, 206.
acutifolia, 207.
cruceana, 207.
Grevilleana, 207.
lucens, 206.
Peoppigiana, 152.
scabriseta, 207.
(?) *Sullivantii*, 207.
varians, 207.
Hygroamblystegium, 72.
fluviatile, 74.
f. brevifolium, 74, 267.
v. ovatum, 74.
irriguum, 72.
f. marianopolitanum, 73.
v. spinifolium, 73.
macroneuron, 265.
noterophilum, 74.
orthocladon, 73.
f. brevinerve, 74.
tenax, 72.
Hygrohypnum, 85.
alpestre, 89.
alpinum, 267.
Bestii, 93.
Closteri, 92.
f. serrulatum, 92.
cochlearifolium, 91.
dilatatum, 93, 267.
eugyrium, 90.
v. *Mackayi*, 90.
molle, 92.
montanum, 94.
Novae-Caesareae, 94.
norvegicum, 92.
ochraceum, 86.
v. filiforme, 87.
v. flaccidum, 87.
v. uncinatum, 87.
palustre, 87.
v. Ehlei, 88.
v. julaceum, 88.
v. subsphaericarpum, 88, 89.
polare, 89.
*pseudomontanum, 89.
Smithii, 91.
styriacum, 88.
*subeugyrium, 91.
v. occidentale, 91.
Hylocomieae, 115.
Hylocomium, 118.
alaskanum, 119.
beringianum, 118.
brevirostre, 120.
californicum, 118.
loreum, 117.
pyrenaicum, 120.
robustum, 116.
rugosum, 115.
splendens, 118.
squarrosum, 116.
triquetrum, 117.
umbratum, 119.
Hypnaceae, 3.
Hypneae, 121.
Hypnum, 122.
abietinum, 176.
acuminatum, 27.
acuticuspis, 13.
acutum, 32.
adnatum, 141.
aduncum, 108.
aeneum, 56.
aggregatum, 10.
alaskae, 128.
alaskanum, 119.
albicans, 33.
albulum, 164.
alleghaniense, 7.
alpestre, 89.
alpinum, 93.
amblyphyllum, 114.
amoenum, 130.
apocladum, 53.
arcticum v., 52.

arcticum, 91.
v. Goulardi, 91.
arcuatiforme, 130.
arcuatum, *129*, 129, 268.
v. americanum, 130.
v. demissum, 130.
v. elatum, 129.
arenarium, 57.
arrenatum, 129.
atrovirens, 186.
badium, 107.
Bakeri, 101.
Bambergeri, 131.
bergenense, 84.
Bigelovii, 8.
Blandowii, 179.
blandum, 51.
Bolanderi, 49.
Boscii, 26.
Brandegei, 25.
Breidleri, 130, 96.
brevifolium, 108.
brevirostrum, 120.
Brewerianum, 10.
byssiraneum, 80.
caespitans, 53.
caespitosum, 53, 54, 139.
californicum, 55.
callichroum, *123*, 128.
caloosiense, 154.
calyptratum, 177.
campaniforme, 150.
canadense, 128.
canariense, 127.
capillifolium, 111.
Cardoti, 81.
carolinianum, 140.
chlorochroum, 130.
chloropterum, 14.
chryseum, 171.
chrysophyllum, 82.
v. *brevifolium*, 83.
v. *tenellum*, 84.
chrysostomum, 43.
ciliare, 227.
cirrosum, 25.
circinale, 126.
circulifolium, 93.
Closteri, 92.
collinum, 48.
columbico-palustre, 88.
commutatum, 77.
compactum, 71.
compressulum, 151.
confervoides, 143.
conflatum, 110.
congestum, 188.
conostegum, 152.
contextum, 69.
cordifolium, *42*, 96.
v. *stenodictyon*, 97.
crassiusculum, 139.
crispifolium, 181.
Crista-castrensis, 134.
cubense, 150.
cupressiforme, 124.
v. *corruscans*, 130.
v. *ericetorum*, 124.
v. filiforme, 124.
v. resupinatum, 124.
v. subjulaceum, 124.
curvifolium, 125.
curvisetum, 24.
cuspidatum, 102.
cyclophyllotum, 97.
cylindricarpum, 136.
declivum, 47.
decursivulum, 84.
delicatulum, 174.
demissum, 140.
v. *marylandicum*, 140.
dendroides, 5.
denticulatum, 156.
v. *succulentum*, 158.
depressulum, 132.
depressum, 161.
Dieckii, 128.
dilatatum, 93.
diminutivum, 150.
dimorphum, 183.
distans, 16.
diversifolium, 20.
Donianum, 157.
Donnellii, 154.
elegans, 163.
erectum, 27.
eugyrium, 90.
exannulatum, 113.
falcatum, 78.
v. *microphyllum*, 78.
fastigiatum, 131.
Fendleri, 48.
fertile, 126.
filicinum, 76.
filiforme, 133.
fimbriatum, 120.
Fitzgeraldi, 50.
flaccum, 137.
flagellare, 43.
flavescens, 33.
Flemingii, 116.
fluitans, 112.
fluviatile, 72, 74.
fulgescens, 56.
fulvum, 164.
geminum, 133.
giganteum, 97, 112.
v. *dendroides*, 98.
fluitans, 98.
glareosum, 37.
glaucum, 77.
Goulardi, 91.
gracile, 177, 199.
lancastriense, 178.
gracilescens, 192.
graminicolor, 15.
Haldanianum, 137.
Halleri, 80.
hamifolium, 112.
hamulosum, 130, *131*.
Heufleri, 132.
hians, 16.
hispidulum, 79.
hygrophilum, 84.
hyperboreum, 98.
illecebrum, *26*, 51, 99.
implexum, 128.
imponens, 123.
intermedium, 107.
intricatum, 46, 147.
inundatum, 192.
irrigatum, 267.
irriguum, 72.
v. *spinifolium*, 74.
Kegelianum var. *tenue*, 139.
Krausei, 89, 90.
laetum, 34.
lanatum, 179.
laxepatulum, 136.
laxifolium, 44.
lentum, 53.
Lescurii, 75.
Lindbergii, 129.
longifolium, 65.
loreum, 117.
luridum, 87.
lutescens, 56, 267.
lycopodioides, 107.
Macounii, 80.
malacocladum, 86.
marylandicum, 140.
micans, 94, 164.
microcarpum, 139.
microphyllum, 177.
minutissimum, 144.
minutulum, 177.
molle, 92.
molluscoides, 135.
molluscum, 134.
v. condensatum, 134.
v. fastigiatum, 134.
v. molluscoides, 135.
Montagnei, 152.
montanum, 94.
Moseri, 105.
multiflorum, 191.
myosuroides, 12.
v. *stoloniferum*, 13.
tenue capsulis nutantibus, 12.
neckeroides, 7.
nemorosum, 138.
nevadense, 59.
nitens, 58.
nitidulum, 163.
noterophilum, 74.
Novae-Angliae, 14.
Novae-Caesareae, 94.
Nuttallii, 60.
Oakesii, 120.
obsoletinerve, 133.
obtusifolium, 52, 157.
occidentale, 184, 264.
ochraceum, 86.
orbiculari-cordatum, 96.
oreganum, 22.
orthocarpum, 170.
orthocladon, 74.
oxycladon, 34.
*pallescens, *131*, 132.
paludosum, 180.
palustre, 87.
v. *julaceum*, 88.
parietinum, 103.
Patientiae, 129, 268.

patulum, 214.
perspicuum, 150.
piliferum, 26.
pinnatifidum, 57.
planifolium, 163.
planum, 150.
plesistramineum, 101.
plumiferum, 128.
plumosum, 43.
salebrosum, 31.
turgidum, 37
polare, 88, 89.
polyanthos, 145.
polyanthum pallidifolium, 145.
polycarpon, 110.
polycarpum, 191.
polygamum, 83.
v. *longinerve*, 84.
v. *minus*, 83.
polymorphum, 82.
populeum, 44.
praecox, 18.
praelongum, 15, 16, 20.
pratense, 130.
procerrimum, 135.
proliferum, 118.
protensum, 81, 175.
pseudoarcticum, 88, *93*.
pseudocircinale, 126.
pseudocomplexum, 85, 267.
pseudo-drepanium, 129.
pseudofastigiatum, 124.
pseudomontanum, 89, 267.
pseudo-plumosum, 43.
pseudo-pratense, 130.
pseudo-sarmentosum, 99.
pseudosericeum, 56.
pseudo-silesiacum, 165.
pseudostramineum, *100*, 101.
pulchellum, 17.
pyrenaicum, 120.
radicale, 67, 70, 84.
radicosum, 188.
ramulosum, 181.
recognitum, 175.
recurvans, 135.
reflexum, 44.
Renauldii, 129.
reptile, 132.
revolutum, 132.
v. *Molendoanum*, 133.
v. *pygmaeum*, 133.
revolvens, 106.
Richardsoni, 96.
riparoides, 23.
riparium, 64.
v. *fluitans*, 65.
rivulare, 89.
robustum, 116.
Roellii, 137.
Roeseanum, 158.
Royae, 20.
rusciforme, 22.
Rugelii, 203.
rugosum, 115.
rutabulum, 38.
v. *campestre*, 32.
ruthenicum, 6.
salebrosum, 31.
sarmentosum, 98.
v. *fallaciosum*, 99.
v. *fontinaloides*, 98.
Sauteri, 131.
saxicola, 44.
scabridum, 14.
schistocalyx, 179.
Schreberi, 103.
scitum, 175.
scorpioides, 94.
v. *miquelonense*, 107.
Sendtneri, 111.
v. *Wilsoni*, 112.
sequoieti, 126.
sericeum gracile albicans, 33.
serpens, 69.
serrulatum, 23.
silesiacum, 166.
sinuolatum, 82.
sipho, 66.
Sommerfeltii, 80.
spiculiferum, 13.
spinulosum, 69.
splendens, 118.
squamulosum, 150.
squarrosum, 116.
squarrosulum, 183.
Starkei, 46.
stellatum, 81.
stereodon cuspidatus, 102.
Stereodon Laureri, 44.
Stereodon virginianus, 178.
stereodon stramineum, 99.
stoloniferum, 12.
stramineum, 99.
v. *foliis latioribus*, 99.
strigosum, 17.
styriacum, 88.
subcomplexum, 125.
subeugyrium, 91.
v. *occidentale*, 91.
subflaccum, 130.
subgiganteum, 96.
subimponens, 127.
v. cristulum, 128.
subplicatile, 128.
subrectifolium, 138.
subsecundum, 82.
subsimplex, 164.
subsphaericarpon, 88.
subtenue, 44.
subturgescens, 94.
sulcatum, 77.
v. *stenodictyon*, 77.
Sullivantiae, 158.
Sullivantii, 15.
sylvaticum, 157.
symmetricum, 105.
tenerum, 164.
tenue, 69.
thelistegum, 150.
thuringicum, 17.
trichopodium, 67.
trichophorum, 159.
trifarium, 99.
triquetrum, 117.
torrentis, 91.
Touretii, 51.
Treleasei, 81.
tundrae, 100.
turfaceum, 165.
turgescens, 100.
turgidum, 37.
umbratum, 119.
uncinatum, 105.
v. *plumulosum*, 106.
undulatum, 160.
unicostatum, 82, 83.
*Vaucheri, 125.
vagans, 267.
Vallis-Clausae, 267.
vallium, 39.
velutinoides, 17.
velutinum, 46.
vernicosum, 106.
vesiculare, 152.
viridulum, 92.
Waghornei, 127.
Watsoni, 132.
Whippleanum, 180.
Wrightii, 154.
Hypopterygiaceae, 205.
Hypopterygium, 206.
canadense, 206.
japonicum, 206.

Isopterygium, 162.
Isothecium, 12.
apiculatum, 198.
Cardoti, 13.
hylocomiodes, 11.
Howei, 10.
myosuroides, 12.
myurum, 11.
murellum, 13.
obtusatulum, 113.
occidentale, 264.
pleurozoides, 13.
stoloniferum, 12.
substoloniferum, 14.

Jaegerinopsis, 215.
scariosum, 215.
squarrosa, 215.

Lasia subcapillata, 61.
Leptodictyum, 63.
brevipes, 66.
riparium, 64.
v. abbreviatum, 65.
v. brachyphyllum, 65.
v. elongatum, 66.
f. flaccidum, 65.
f. fluitans, 65.
f. longifolium, 65.
f. obtusum, 65.
sipho, 66.
trichopodium, 67.
v. curvipes, 68.
v. Kochii, 67, *79*.
f. robustum, 68.
f. simulans, 68.
vacillans, 67.
Leptodon, 220.
circinnatus, 225.

floridanus, 221.
immersus, 221.
nitidus, 222.
ohioensis, 221.
trichomitrion, 220.
v. floridianus, 221.
v. immersus, 221.
Lescuraea, 185.
frigida, 190.
imperfecta, 190.
radicosa, v. *gracilis*, 190.
stenophylla, 190.
Leskeaceae, 173.
Leskea, 191.
acuminata, 27.
adnata, 139.
apiculata, 203.
arcuata, 135.
arenicola, 192.
asperella, 200.
attenuata, 203.
Austinii, 196.
australis, 193.
Beyrichii, 27.
Bonplandii, 61.
bulbifera, 193.
caespitosa, 139.
(?) *Cardoti*, 193.
complanata, 210.
compressa, 169.
cyrtophylla, 195.
denticulata, 232.
Fendleri, 48.
fragilis, 204.
gracilescens, 192.
intermedia, 192.
intricata, 172.
involvens, 176.
julacea, 198.
latebricola, 159.
laxifolia, 44.
microcarpa, 193.
montanae, 75, 194.
nervosa, 193.
v. *flagellifera*, 194.
v. nigrescens, 194.
nigrescens, 194.
obscura, 193.
obtusa, 193.
pallescens, 132.
paludosa, 192.
v. *polycarpa*, 191.
palustris, 192.
parvula, 231.
(?) *patens*, 186.
pellucinervis, 182.
pilifera, 159.
polycarpa, 191.
v. paludosa, 192.
v. *subobtusifolia*, 192.
pulchella, 162.
pulvinata, 232.
recurvans, 135.
rigescens, 190.
rostrata, 204.
Seligeri, 166.
setosa, 27.
Smithii, 91.
Sprucei, 144.
squarrosa, 135.
striatella, 160.
subcyrtophylla, 195.
subobtusifolia, 192.
subtilis, 143.
tectorum, 195.
v. flagellifera, 195.
tenuirostris, 136.
tristis, 204.
varia, 70.
Williamsii, 194.
v. filamentosa, 195.
Wollei, 195.
Leskia rutilans, 152.
subpinnata, 139.
Leucodoniopsis, 219.
plicata, 219.
Leucodontaceae, 217.
Leucodon, 217.
brachypus, 217.
domingensis, 219.
julaceus, 218.
f. flagelliferus, 218.
sciuroides, 218.
Leucodontopsis, 219.
floridana, 219.
Limnobium, 85.
arcticum, 91.
Bestii, 93.
cochlearifolium, 91.
eugyrium, 90.
molle, 92, 93.
norvegicum, 92.
palustre, 87.
submolle, 92.
Lindbergia, 196.
Austinii, 196.
brachyptera, 196.
v. Austinii, 196.

Macounia sciuroides, 188.
Meteoriaceae, 213.
Meteoriopsis, 214.
patula, 214.
Meteorium nigrescens, 214.
pendulum, 214.
scariosum, 216.
Microthamnium, 150.
Mittenothamnium, 150.
diminutivum, 150.
Myrinia, 232.
(?) Dieckii, 232.
pulvinata, 232.
Myurella, 198.
apiculata, 198.
Careyana, 199.
gracilis, 199.
julacea, 198.
v. scabrifolia, 198.
squarrosa, 199.
tenerrima, 198.
Myurium Boscii, 26.
(?) *Herjedalicum*, 25.

Neckeraceae, 208.
Neckera, 208, *257*.
abietina, 225.
breviseta, 170.
californica, 226.
capillacea, 261.
chlorocaulis, 209.
cladorrhizans, 167, 170.
complanata, 210.
crispa, 208.
curtipendula, 224.
decipiens, 197.
dendroides americana, 5.
disticha, 211.
Douglasii, 210.
falcata, 259.
floridana, 219.
gracilis, 210.
leucoclada, 261.
ludoviciae, 216.
Menziesii, 211.
v. limnobioides, 211.
minor, 202.
neomexicana, 212.
nigrescens, 214.
oligocarpa, 209.
v. *pterantha*, 209.
pennata, 209.
v. oligocarpa, 209.
f. pterantha, 209.
pterantha, 209.
repens, 148.
sciuroides, 201.
seductrix, 168.
subulata, 258.
Sullivantii, 169.
undulata, 211.
viticulosa, 202.
v. *minor*, 201, 202.

Omalia, *151*, 212.
Wrightii, 154.
Orthothecium, 171.
acuminatum, 173.
Orthotrichum splachnoides, 230.
Oxyrhynchium Rappii, 17.

Papillaria, 213.
nigrescens, 214.
sciuroides, 201.
Pilotrichella, 214.
cymbifolia, 216.
floridana, 219.
Pilotrichum, 235.
antipyreticum, 235.
cymbifolium, 216
dalecarlicum, 245.
distichum, 241, 242.
flagelliferum, 219.
sphagnifolium, 241.
Strömbäckii, 250.
Pireella, 216.
cavifolia, 216.
cymbifolia, 216.
ludoviciae, 216.
Plagiothecieae, 155.
Plagiothecium, 155.
aciculari-pungens, 158.
attenuatirameum, 159.
bifariellum, 160.
brevipungens. 130, 160.

curvifolium, 157.
decursivifolium, 159.
denticulatum, 156.
v. aptychus, 157.
ssp. *aptychus*, 157.
v. Donii, 157.
f. propaguliferum, 157.
v. tenellum, 157.
elegans, 163.
v. gracilens, 164.
v. Schimperi, 163.
deplanatum, *130*, 161.
fallax, 158.
Fitzgeraldi, 160.
geophilum, 161.
Groutii, 165.
*laetum, 158.
latebricola, 159.
micans, 164.
v. fulvum, 164.
v. Groutii, 165.
v. *latifolia*, 165.
f. latifolium, 165.
v. minus, 165.
missourianum, 161.
Muellerianum, 162.
Muhlenbeckii, 160.
nitidulum, 163.
orthocladium, 158.
passaicense, 162.
piliferum, 159.
pseudo-latebricola, 162.
pulchellum, 162.
v. nitidulum, 163.
repens, 166.
*Roeseanum, 158.
*Ruthei, 158.
Sandbergii, 159.
Schimperi, 163.
Seligeri, 166.
silesiacum, 166.
striatellum, *79*, 160.
subfalcatum, 166.
sulcatum, 165.
*sylvaticum, 157.
v. orthocladium, 158.
v. succulentum, 158.
turfaceum, 165.
undulatum, 160.
v. myurum, 160.
Platygyrium, 148.
brachycladon, 61.
fuscoluteum, 149.
repens, 148, *149*, *204*.
v. ascendens, 149.
v. orthoclados, 149.
v. *sciuroides*, 149.
rupestre, 151.
Platyhypnidium rusciforme, 22.
Pleuropus Bonplandii, 61.
Pleuroziopsis, 6.
Pleurozium Schreberi, 103.
Porothamnium, 8.
Bigelovii, 8.
(?) *neomexicanum*, 212.
Porotricheae, 6.
Porotrichum, 7.
alleghaniense, 7.
alopecurum, 8.
neckeroides, 7.
Pseudisothecium, 12.
myosuroides, *11*, 12.
v. filescens, 12.
stoloniferum, *11*, 12.
v. Cardoti, 13.
v. myurellum, 13.
Pseudo-calliergon, 100.
Pseudocryphaea, 219.
flagellifera, 219.
Pseudoleskea, 185.
arizonae, 187.
atricha, 189.
atrovirens, 186.
v. *atricha*, 189.
v. *patens*, 186.
Baileyi, 189.
denudata, 188.
v. Holzingeri, 188.
frigida, 190.
heterocladioides, 186.
integrifolia, 187.
malacoclada, 195.
oligoclada, 186.
pallida, 187.
v. filescens, 187.
radicosa, 188.
v. compacta, 189.
rigescens, 190.
v. Howei, 190.
sciuroides, 188.
v. *denudata*, 188.
stenophylla, 190.
substriata, 190.
tectorum, 195.
tenella, 186.
ticinensis, 186.
Pseudoleskeopsis, 264.
occidentalis, 264.
Pseudo-raphidostegium, 135.
brachycladon, 61.
carolinianum, 168.
intricatum, 147.
repens, 148.
Pterygophyllum acuminatum, 207.
lucens, 206, 207.
Pterigynandrum, 197.
brachycladon, 61.
carolinianum, 168.
filiforme, 197.
v. *cristatum*, 197.
v. decipiens, 197.
v. minus, 197.
f. papillosulum, 197.
gracile, 219.
heteropterum, 197.
hirtellum, 200.
intricatum, 147.
julaceum, 218.
nigrescens, 214.
papillosulum, 197.
repens, 148.
(?) *tenerrimum*, 198.
trichomitrion, 220.
Pterobryaceae, 215.
Pterogonium, 219.
ascendens, 149.
brachypterum, 196.
decumbens, 61.
gracile, 219.
heteropterum, 185.
intricatum, 147.
nervosum, 193.
octoblepharis, 227.
procurrens, 183.
repens, 148.
subcapillatum, 61.
tectorum, 195.
Ptilium, 134.
(?) *Ptychodium oligocladum*, 188.
Pylaisia, 145.
denticulata, 146.
filari-acuminata, 146.
heteromalla, 145.
intricata, *61*, 147.
Jamesii, 146.
ontariense, 145.
polyantha, 145.
v. brevifolia, 146.
v. pseudo-platygyria, 146.
pseudo-platygyrium, 146.
Schimperi, 147, 268.
Selwynii, 147, 268.
subdenticulata, 146.
v. *obscura*, 146.
velutina, 147.
Pylaisiella, 145.
intricata, 147.
polyantha, 145.
v. *pseudo-platygyria*, 146.
v. *Jamesii*, 146.
subdenticulata, 146.
Raphidostegium, 138.
carolinianum, 140.
Kegelianum, 139.
marylandicum, 140.
recurvans, 135.
Roellii, 137.
subadnatum, 132.
Whitei, 136.

Rhynchostegiella, 24.
curviseta, 24.
georgiana, 265.
Rhynchostegium delicatulum, 136
deplanatum, 161.
geophilum, 161.
Jamesii, 132.
pseudo-recurvans, 126.
Royae, 21.
rusciforme, 22.
serrulatum, 23.
Rhytidiadelphus, 116.
loreus, 117.
squarrosus, 116.
triquetrus, 117.
v. beringianus, 118.
v. *californicus*, 118.
Rhytidiopsis, 116.
robusta, 116.
Rhytidium, 115.
rugosum, 115.

Schwetschkeopsis, 232.

denticulata, 232.
Sciaromium, 75.
Fryei, 266.
Lescurii, 75.
Scleropodium, 51.
apocladum, 53.
v. obtusum, 91.
caespitosum, 53.
v. sublaeve, 54.
californicum, 55.
colpophyllum, 54.
v. attenuatum, 55.
illecebrum, 51.
obtusifolium, 52.
Scorpidium, 94.
scorpioides, 94.
Sematophyllum, 138.
adnatum, 139.
caespitosum, 139.
carolinianum, 140.
admixtum, 140.
delicatulum, 136.
marilandicum, *90*, 140.
micans, 94.
Roellii, 137.
Smallii, 139.
subpinnatum, 139.
Stereodon, 123.
canariensis, 127.
circularis, 131.
complexus, 124.
geminus, 133.
giganteus, 97.
obtusifolius, 52.
plicatilis, 132.
plicatulus, 128.
plumifer, 127.
revolutus, 132.
Richardsoni, 96.
riparius, 64.
rubellus, 172.
Stereohypnum, 150.
Stereophylleae, 154.
Stereophyllum, 154.
cubense, 154.
Donnellii, 154.
Wrightii, 154.

Taxiphyllum, 161.
Taxithelium, 150.
planum, 150.
Thamnium alleghaniense, 7.
Holzingeri, 9.
Leibergii, 7.
micro-alopecurum, 8.
pseudoneckeroides, 7.
Thelieae, 197.
Thelia, 200.
asperella, 200.
compacta, 200.
hirtella, 200.
Lescurii, 200.
robusta, 200.
Thuidieae, 173.
Thuidium, 173.
abietinum, 176.
Alleni, 175.
Blandowii, 179.
decipiens, 78.
delicatulum, 175.
delicatulum, 174.
elodioides, 180.
glaucinum, 175.
intermedium, 174.
involvens, 176.
leskeoides, 180.
leuconeurum, 181.
lignicola, 178.
microphyllum, 177.
v. lignicola, 178.
v. obtusum, 178.
f. papillosum, 177.
v. Ravenelii, 178.
minutulum, 177.
paludosum, 180.
*Philibertii, 174.
pseudo-abietinum, 179.
punctulatum, 178.
pygmaeum, 177.
recognitum, 175.
schistocalyx, 179.
scitum, 175.
v. aestivale, 176.
virginianum, 178.
Tomenthypnum nitens, 58.
Tricholepis, 213.
nigrescens, 214.
v. Donnellii, 214.
Tripterocladium, 151.
Brewerianum, 10.
compressulum, 151.
leucocladulum, 151.
Triquetrella californica, 201.
ferruginea, 201.
Vesicularia, 151.
amphibola, 153.
crassicaulis, 153.
malachita, 152.
vesicularis, 152.
v. Poeppigiana, 152.

PLATE XLV.

PLATE 45. Figures 1–10. *Claopodium crispifolium.* 1, moist × 1; 2, portion of same, dry; 3, portion of stem, dry × 5; 4, leaves × 30; 5, apex of leaf × 150; 6, basal cells × 150; 7, median marginal cells × 150; 8, portion of cross section of leaf showing papillae × 150; 9, outline of cross section of leaf base × 20; 10, capsules × 10.

Figures 11–17. *Claopodium Bolanderi.* 11, dry × 2; 12, portion of same × 5; 13, stem leaves × 20; 14, leaf apex × 150; 15, basal cells × 150; 16, median marginal cells × 150; 17, capsules × 10.

Figures 18–25. *Claopodium pellucinerve.* 18, portion of plant, moist × 8; 19, same dry × 8; 20, portion of stem × 20, showing papillae; 21, stem leaves × 30; 22, branch leaves × 30; 23, leaf apex × 150; 24, basal cells × 150; 25, median marginal cells × 150. (Drawings by Seville Flowers.)

PLATE 46. A. *Claopodium Whippleanum leuconeurum* (from Sull. Icones Musc. Suppl. *pl. 80*). 3, portion of branch much magnified; 11 and 12, apex and base of leaf respectively, showing cells.

B. *Claopodium Whippleanum* (from Sull. Pacific R. R. Reports **4**: *pl. 9*). 3, fertile plant much magnified; 5, portion of branch; 6, leaves; 14, perichaetial leaf (see Dr. Best's remarks, Bull. Torr. Bot. Club **27**: 29 & 30). These drawings represent the type fairly well (co-type seen), but as a rule the leaves have a much longer and more slender acumination, much like the figure of the perichaetial leaf.

C. *Myurella squarrosa*. 1, plant × 1; 2, portion of plant × 10; 3, four leaves × 20; 4, 5, 6, basal, median-marginal and central-median leaf cells respectively × 300; 7, capsule × 10; 8, apical cells × 300. (By Seville Flowers.)

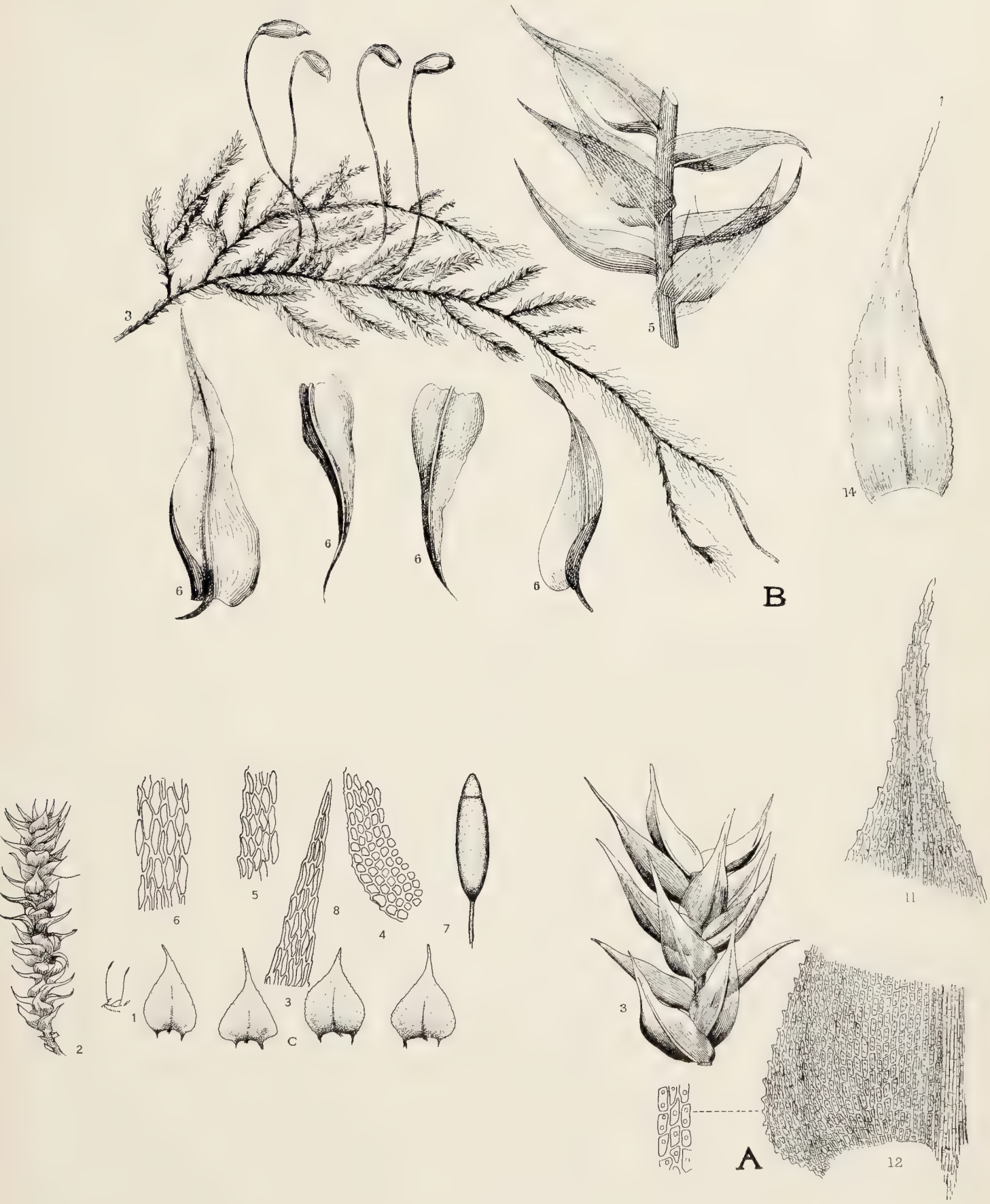

PLATE XLVI.

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PLATE XLVII.

PLATE 47. (From Bull. Torr. Club. **28:** *pl. 14*). *Heterocladium Macounii;* 1, plant, natural size; 2, portion of secondary stem showing arrangement of leaves × 18½; 3, 4, outlines of secondary stem leaves × 25; 5, basal portion of secondary stem leaf × 120; 6, apex of same × 120; 7, apex of some of the secondary stem leaves × 120; 8, central cells from secondary stem leaf × 210; 9, marginal cells from same × 210; 10, marginal cells showing papillae × 500; 11, cross-section of secondary stem leaf showing papillae × 270; 12, 13, 14, paraphyllia × 57½; 15, outline of ultimate branch leaf × 35; 16, apex of ultimate branch leaf × 120; 17, cross-section of stem × 57½; 18, capsule × 8; 19, operculum × 15.

Heterocladium heteropterioides; 20, plant, natural size; 21, portion of stem showing arrangement of leaves × 18½; 22, 23, outlines of stem leaves × 25; 24, 25, paraphyllia × 162½; 26, basal portion of stem leaf × 210; 27, apex of same × 210; 28, central cells from stem leaf × 210; 29, marginal cells showing papillae × 500; 30 cross-section of stem leaf showing papillae × 270; 31, 32, outlines of ultimate branch leaf × 45; 33, apex of ultimate branch leaf × 210; 34, cross-section of stem × 57½; 35, capsule × 8; 36, operculum × 11½; 37, portion of annulus and capsule × 120.

PLATE 48. (From Bull. Torr. Club. 28: *pl. 13*). *Heterocladium procurrens;* 1, plant, natural size; 2, portion of stem showing arrangement of leaves × 11½; 3, 4, 5, outlines of stem leaves × 11½; 6, basal portion of stem leaf × 87½; 7, cells from middle portion of stem leaf × 87½; 8, cells from center of stem leaf, showing the two veins the walls of which are shaded × 120; 9, apex of stem leaf × 87½; 10, paraphyllium × 57½; 11, paraphyllium showing width of walls × 87½; 12, ultimate branch showing arrangement of leaves × 11½; 13, leaf from ultimate branch × 15; 14, basal portion of branch leaf × 87½; 15, apex of same × 87½; 16, capsule, dry × 8; 17, operculum × 8.

Heterocladium squarrosulum; 18, plant, natural size; 19, portion of primary stem showing arrangement of leaves × 18½; 20, 21, outlines of primary stem leaves × 18½; 22, basal portion of primary stem leaf × 120; 23, apex of same × 120; 24, central cells from primary stem leaf × 207½; 25, marginal cells from the same × 207½; 26, paraphyllium showing cells × 87½; 27, 28, paraphyllia × 45; 29, 30, outlines of secondary stem leaves × 18½; 31, apex of secondary stem leaf × 120; 32, cross-section of secondary stem leaf showing papillae × 270; 33, portion of ultimate branch showing arrangement of leaves when moist × 18½; 34, portion of ultimate branch showing arrangement of leaves when dry × 18½; 35, 36, 37, outlines of ultimate branch leaves × 25; 38, oblique view of ultimate branch leaf showing papillae × 87½; 39, apex of ultimate branch leaf × 120; 40, operculum × 15.

PLATE XLVIII.

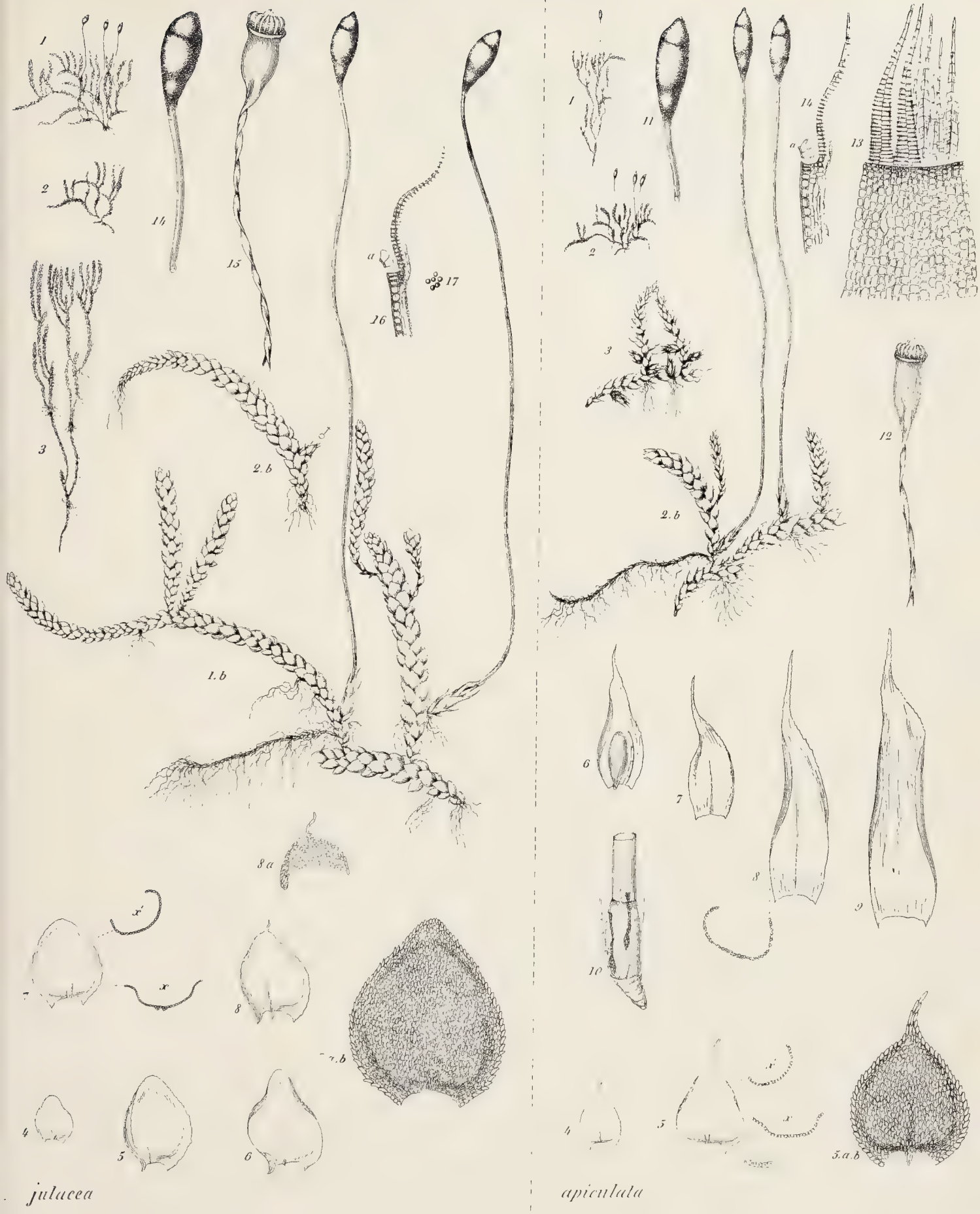
PLATE XLIX.

PLATE 49. A. *Thelia Lescurii* (from Sull. Icones Musc. *pl. 82*). 5, leaf; 6, 7, base and apex of leaf showing cells; 8, a few cells showing papillae; 14, capsule; 15, 18, peristome; 17, operculum.

B. *Thelia hirtella* (from Sull. l. c. *pl. 80*). 1, plant × 1; 2, branch; 3, 4, branch leaves; 5, 6, apical and basal cells; 7, five cells showing papillae; 8, cross sections of leaf; 9, apex of perichaetial leaf; 10, perichaetium; 11, perichaetial leaf; 12, marginal cilium of leaf; 13, capsules; 14, 15, 16, peristome; 17, operculum.

PLATE 50. (From Bry. Eur. pl. 560). *Myurella juacea.* 1, 2, creeping plants; 3, plant fron a dense tuft; 1b, 2b, portions of plant much magnified; 4–7, leaves; 7ab, leaf showing areolation; 8, 8a, rare apiculate leaves; 14, 15, capsules; 16, peristome and annulus in longitudinal section.

Myurella apiculata (*tenerrima*). 1, 2, plants; 2b, 3, portions of plants more enlarged; 4, 5, leaves; 5 ab, leaf showing areolation; 6, perigonial leaf and antheridium; 7, 8, 9, perichaetial leaves; 11, 12, capsules; 13, part of peristome; 14, portion of peristome and annulus in longitudinal section.



HYPNACEAE
Myurella

PLATE L.

PLATE LI.

PLATE 51. A. *Lindbergia Austinii* (from Sull. Icones Musc. Suppl. *pl. 61*). 2, portion of branch showing leaves and paraphyllium; 3, leaf; 4, leaf cells of base and apex; 5, cross sections of leaf; 6, perichaetial leaf; 7, capsule and operculum; 8, 9, 10, peristome and spores.

B. *Myurella Careyana* (from Sull. Icones Musc. *pl. 83*). 1, fertile plant much magnified; 4, part of a branch; 5, 6, branch leaves; 7, 8, leaf base and apex showing cells; 9, four cells showing papillae; 14, capsules; 15, calyptra; 16, operculum; 17, peristome.

PLATE 52. (From Bull. Torr. Bot. Club **30**: plates 15 & 16).

Leskea microcarpa

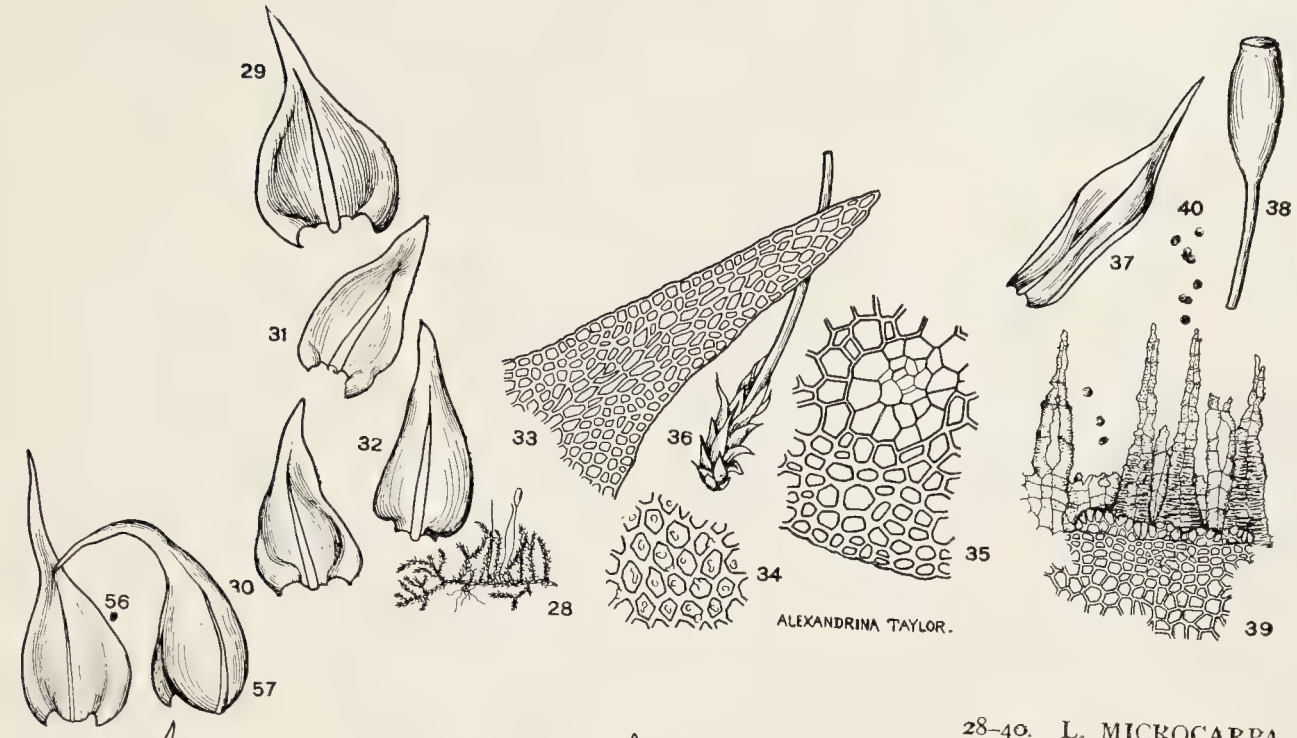
28. Plant, natural size.
29. Outline of stem-leaf. × 44.
30, 31, 32. Outlines of branch-leaves. × 44.
33. Apex of stem-leaf. × 170.
34. Median cells of leaf. × 390.
35. Cross-section of stem. × 235.
36. Perichetial bud. × 7½.
37. Inner perichetial bract. × 18.
38. Capsule. × 9.
39. Peristome (annulus for the most part of one row). × 100.
40. Spores. × 100.

Leskea Williamsi

55. Plant, natural size.
56, 57. Outlines of stem-leaves. × 44.
58, 59, 60. Outlines of branch-leaves. × 44.
61. Apex of stem-leaf. × 130.
62. Median cells of leaf. × 310.
63. Cross-section of stem. × 130.
65. Perichetial leaf. × 20.
66. Capsule. × 15½.
67. Peristome. × 130.
68. Spores. × 130.

Leskea tectorum

69. Plant, natural size.
70. Outline of a portion of stem. × 20.
71. Outline of stem-leaf. × 44.
72. Outline of branch-leaf. × 44.
73. Apex of stem-leaf. × 130.
74. Median cells of leaf. × 310.
75. Cross-section of leaf. × 130.
76. Cross-section of stem. × 130



28–40. L. MICROCARPA.

LESKEA

55–68. L. WILLIAMSI. 69–76. L. TECTORUM.

PLATE LII.

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PLATE LIII.

PLATE 53. (From Bull. Torr. Bot. Club. **27:** *plates 6 and 7*). *Pseudoleskea atrovirens;* 1, upper and lower leaves; 2, outer and inner perichetial leaves; 3, paraphyllium; 4, apex of leaf; 5, median cell; 6, alar cells; 7, cross-section.

Pseudoleskea oligoclada; 8, branch leaves; 9, stem leaf; 10, paraphyllium; 11, apex of leaf; 12, median cells; 13, alar cells; 14, cross-sections of leaf; 15, capsules; 25, capsule with lid; 30, peristome.

Pseudoleskea pallida; 16, stem leaves; 17, paraphyllium; 18, apex of leaf; 19, median cells; 20, alar cells.

Pseudoleskea denudata; 22, branch leaves; 23, stem leaf; 24, simple and divided paraphyllia; 25, apex of leaf; 26, median cells; 27, alar cells; *Var. Holzingeri;* 28, horizontal and arcuate capsules; 29, peristome.

PLATE 54. (From Bull. Torr. Bot. Club. **27**: l. c.). *Pseudoleskea radicosa;* 1, branch leaf; 2, stem leaf; 3, perichaetial leaf; 4, apex of leaf; 5, median cells; 6, alar cells; 7, cross-section of leaf; 8, back of costa near apex; 9, paraphyllium; 30, two curved capsules, with and without lid; 31, peristome with oblong-lanceolate segments.

Pseudoleskea rigescens; 10, stems leaves; 11, perichetial leaf; 12, paraphyllium; 13, apex of leaf; 14, median cells; 15, alar cells; 16, cross-section; 32, two straight capsules, with and without lid; 33, peristome with linear segments.

Pseudoleskea substriata; 17, branch leaf; 18, stem leaves; 19, paraphyllium; 20, apex of leaf; 21, median cells; 22, basal half of leaf; 23, cross-section; 24, back of costa near the apex.

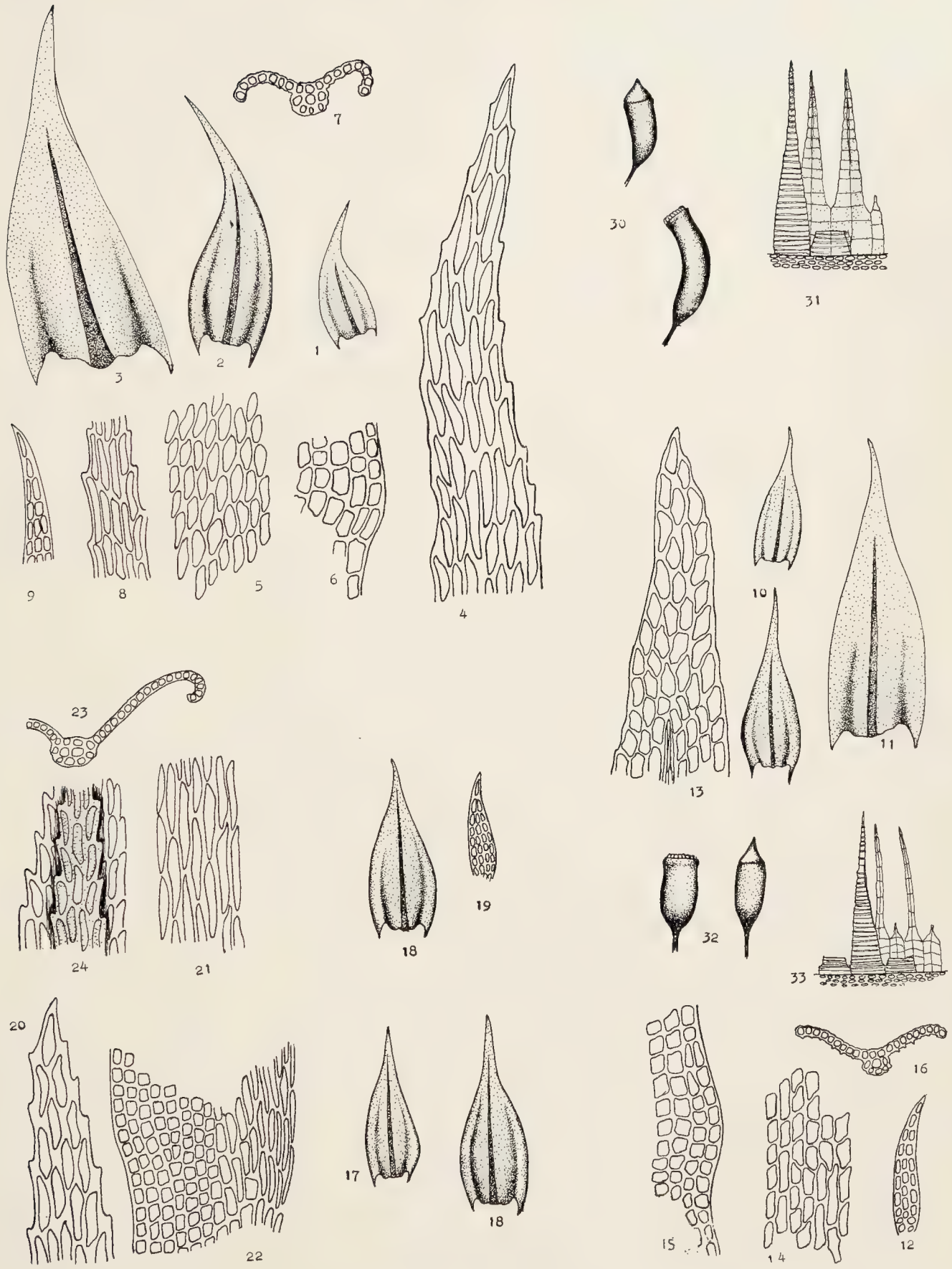
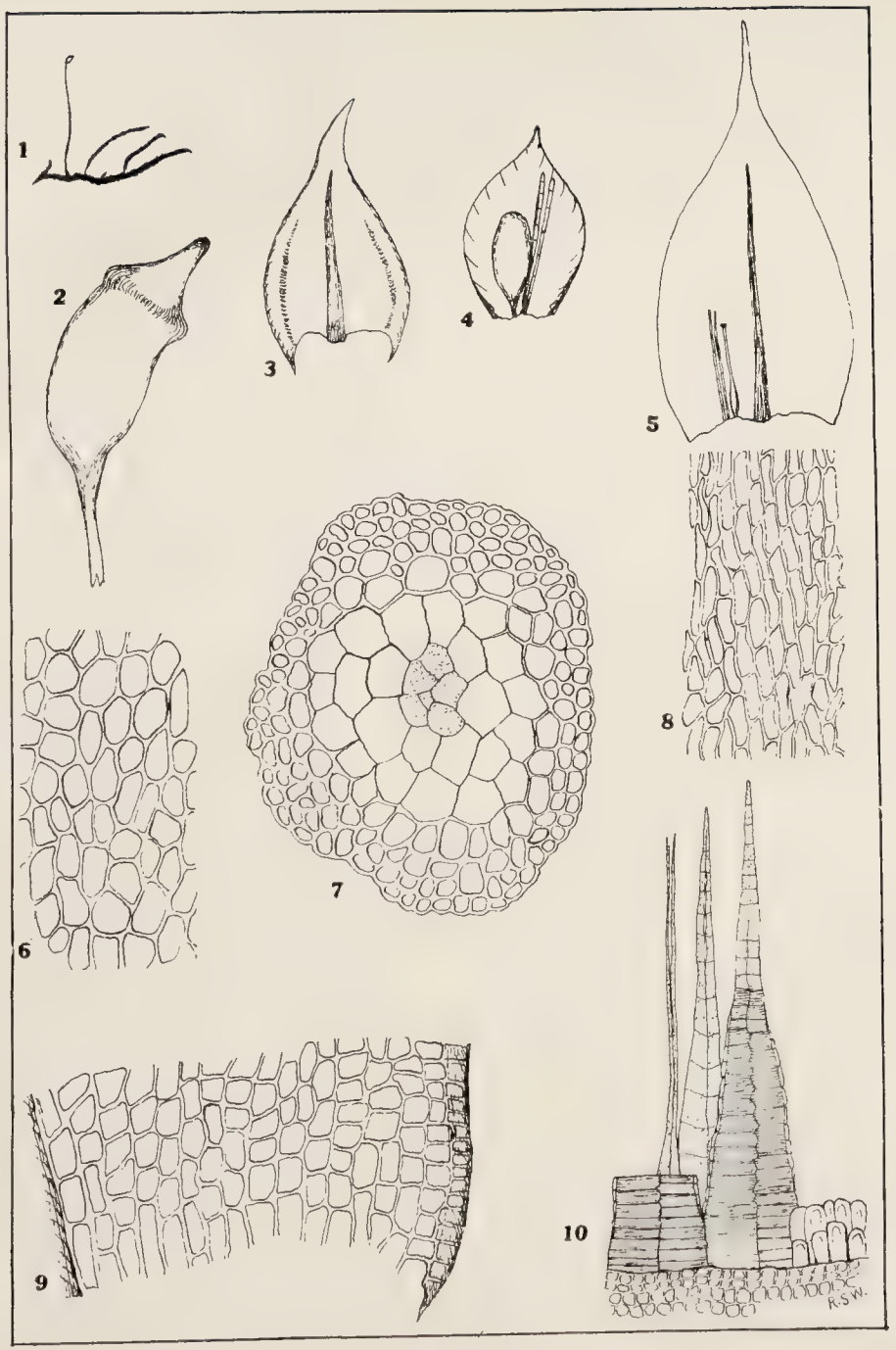


Plate LIV



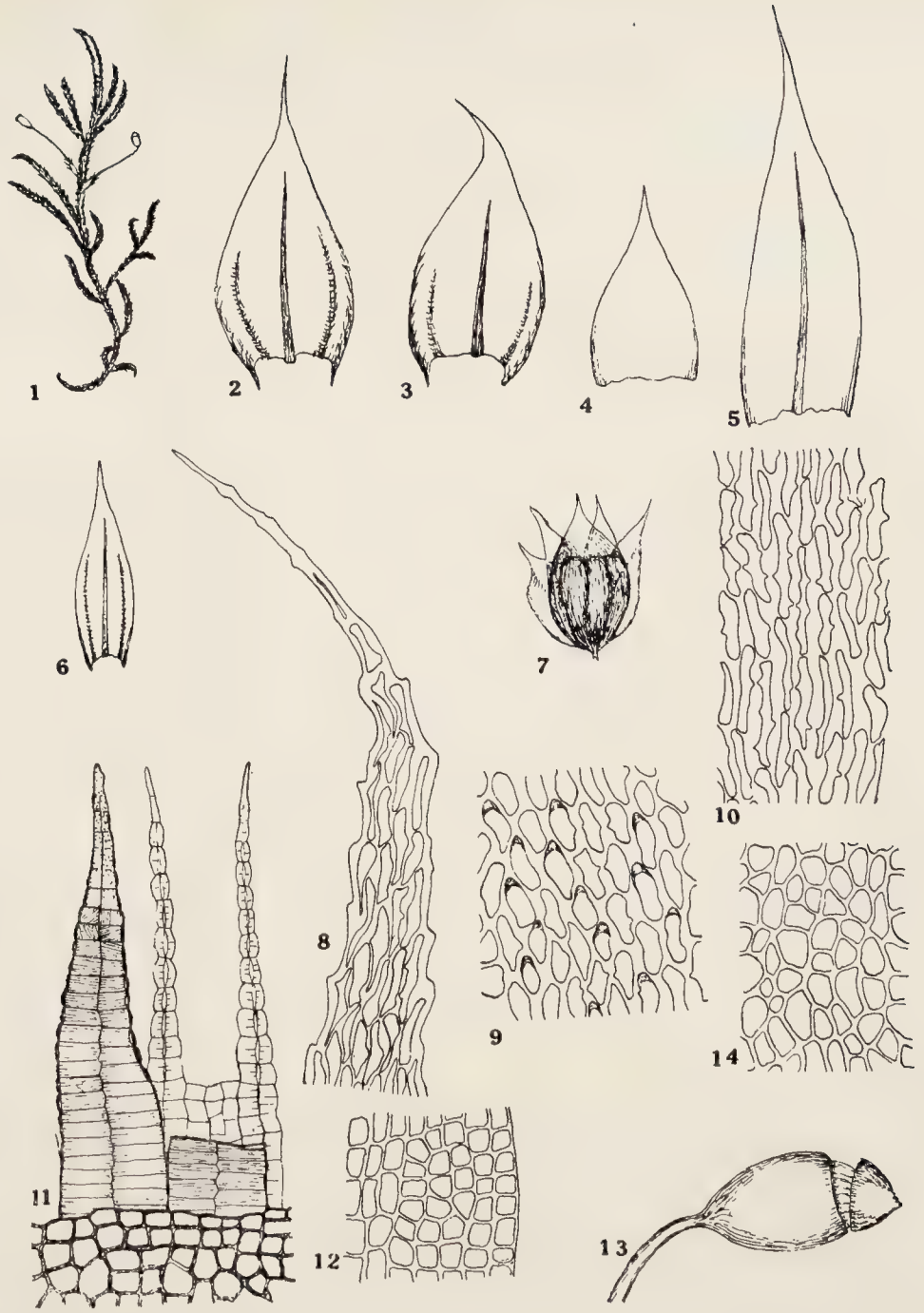


PLATE LV.

PLATE 55. Right. *Pseudoleskea arizonae* (from Bryologist, **33**: *pl. 3*). 1, plants about × 1; 2, capsule × 20; 3, stem leaf × 40; 4, perigonial leaf × 40; 5, perichaetial leaf × 40; 6, median exothecial cells × 300; 7, cross section of stem × 300; 8, median leaf cells × 300; 9, basal cells of stem leaf × 300; 10, part of peristome × 30.

Left. *Pseudoleskea Baileyi* (from Bryologist, **27**: *pl. 13*). 1, plant × 1; 2, 3, stem leaves × 20; 4, 5, outer and inner perichaetial leaf × 20; 6, branch leaf × 20; 7, perigonium × 20; 8, apex of stem leaf × 215; 9, median leaf cells × 215; 10, lower cells near costa × 215; 11, part of peristome × 160; 12, cells at basal leaf angle × 215; 13, capsule × 30; 14, median exothecial cells × 160.

PLATE 56 (from Sull. Icones Musc. *pl. 76*). A. *Herpetineurum toccoae.* 1, female plants × 1; 2, part of a secondary stem; 3, 4, leaves of the same; 5, 6, leaf cells; 7, cross sections of leaves; 8, perichaetium; 9, 10, perichaetial leaves and perigonial; 11, archegonium and paraphysis.

B. *Pireella cymbifolia.* 1, plant × 1; 2, 3, parts of a branch; 4, leaf; 5, 6, basal and apical leaf cells; 7, a few cells much enlarged; 8, cross sections of leaves; 9, 10, 11, perichaetium and perichaetial leaves.

PLATE LVI.

PLATE LVII.

PLATE 57. A. *Pireella ludoviciae.* 1, secondary stem × 2; 2, lower stem leaves × 20; 3, median stem leaves × 20; 4, upper stem leaf × 20; 5, branch leaves × 20.

B. *Meteoriopsis patula.* 1, portion of stem × 7.5; 2, leaves × 20; 3, median leaf cells × 300; 4, apical cells × 300.

C. *Anomodon tristis.* 1, plant × 5; 2, branch × 20; 3, stem leaves × 20; 4, branch leaves × 20; 5, lower marginal leaf cells × 300; 6, median cells × 300; 7, marginal cells × 300.

D. *Alsia californica.* 1, portion of secondary stem × 2; 2, stem leaves × 20; 3, branch leaf × 20; 4, apical leaf cells × 300; 5, lower median cells × 300; 6, basal cells near costa × 300; 7, alar cells × 300; 8, upper median cells × 300; 9, paraphyllia × 300; 10, capsule × 12; 11, peristome × 70 and portion of tooth × 300. (Drawings by Seville Flowers.) (Figures D, 1 and D, 4 are not numbered.)

PLATE 58. A. *Callicostella scabriseta.* 1, fertile stem × 5; 2, three leaves; 3, apical cells; 4, lower and upper median cells showing papillae; 5, basal cells; 6, marginal cells, roughness of margin exaggerated, all cells × 150; 8, capsule with fallen lid × 20; 9, calyptra in place × 20; 10, peristome × 25. The capsule in 1 is out of proportion, being nearly × 10.

B. *Hookeria acutifolia.* 1, portion of plant × 1; 2, two leaves of different size; 3, 4, apical and median leaf cells respectively × 75; 7, apical portion of 1, × 8.

C. *Cyclodictyon varians.* 1, plant × 1; 2, leaves × 20; 3, and 4, apical and median-marginal leaf cells × 75; 7, apical portion of 1 × 8. (All drawings on this plate by Seville Flowers.)

PLATE LVIII.

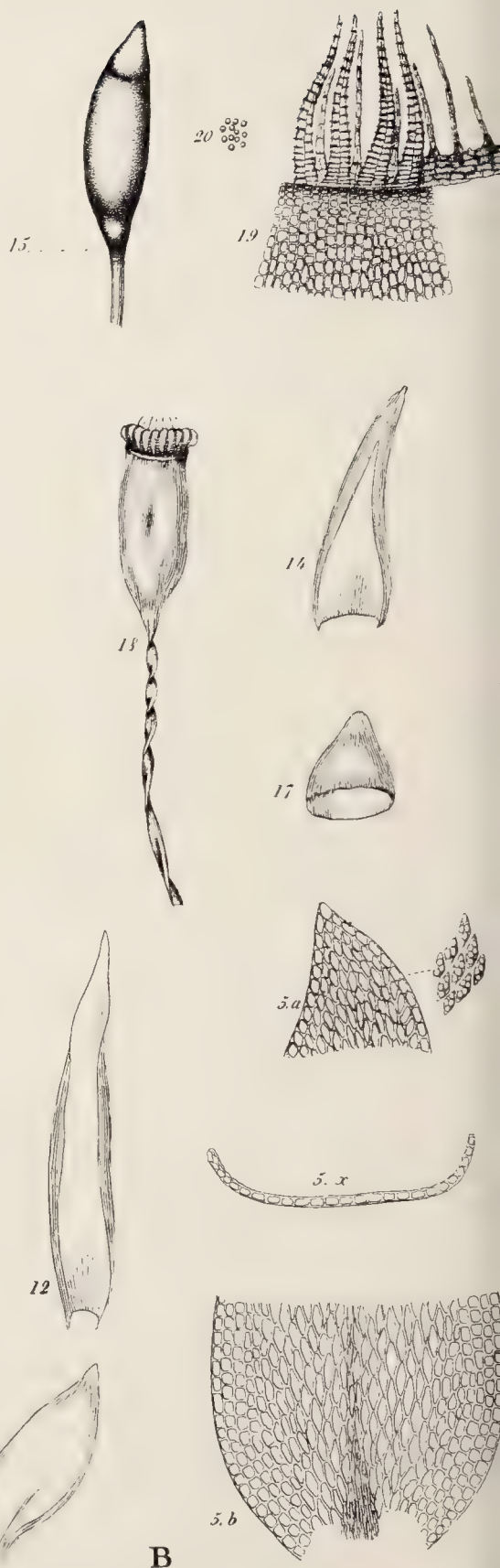


PLATE LIX.

PLATE 59. A. *Hookeria lucens* (from Bry. Eur. *pl. 448*). 1b, branch; 5, 6, upper median leaves; 6a, apical cells; 11, perichaetial leaf; 14, 15, 16, 17, capsules; 18, 19, peristome.

B. *Myrinia pulvinata* (from Bry. Eur. l. c. *pl. 471*). 5, leaf; 5a, 5b, apical and basal leaf cells; 14, calyptra; 15, 18, capsules; 17, operculum.

PLATE 60. A. *Neckera Douglasii;* 1, portion of branch × 8; 2 and 3, leaves × 20; 4, 5, and 6, apical, median and basal cells respectively × 300; 7, perichaetial leaves and capsule × 8.

B. *Neckera disticha;* secondary stem and branches × 2; 2, portion of fruiting plant × 5; 3 and 4, leaves × 20; 5, upper marginal cells on the plane side of leaf; 6, upper marginal cells on the incurved side of the leaf (leaf at left is a left hand leaf; 5 and 6 were from a right hand leaf); 7, sporophyte × 20; 8, perichaetial leaves × 20. (4 not numbered.)

C. *Neckera neo-mexicana;* 1, portion of plant × 1; 2, leaves × 20; 3, 4, 5, and 6, apical, upper median, lower median and median leaf cells respectively × 300. (Drawings by Seville Flowers.)

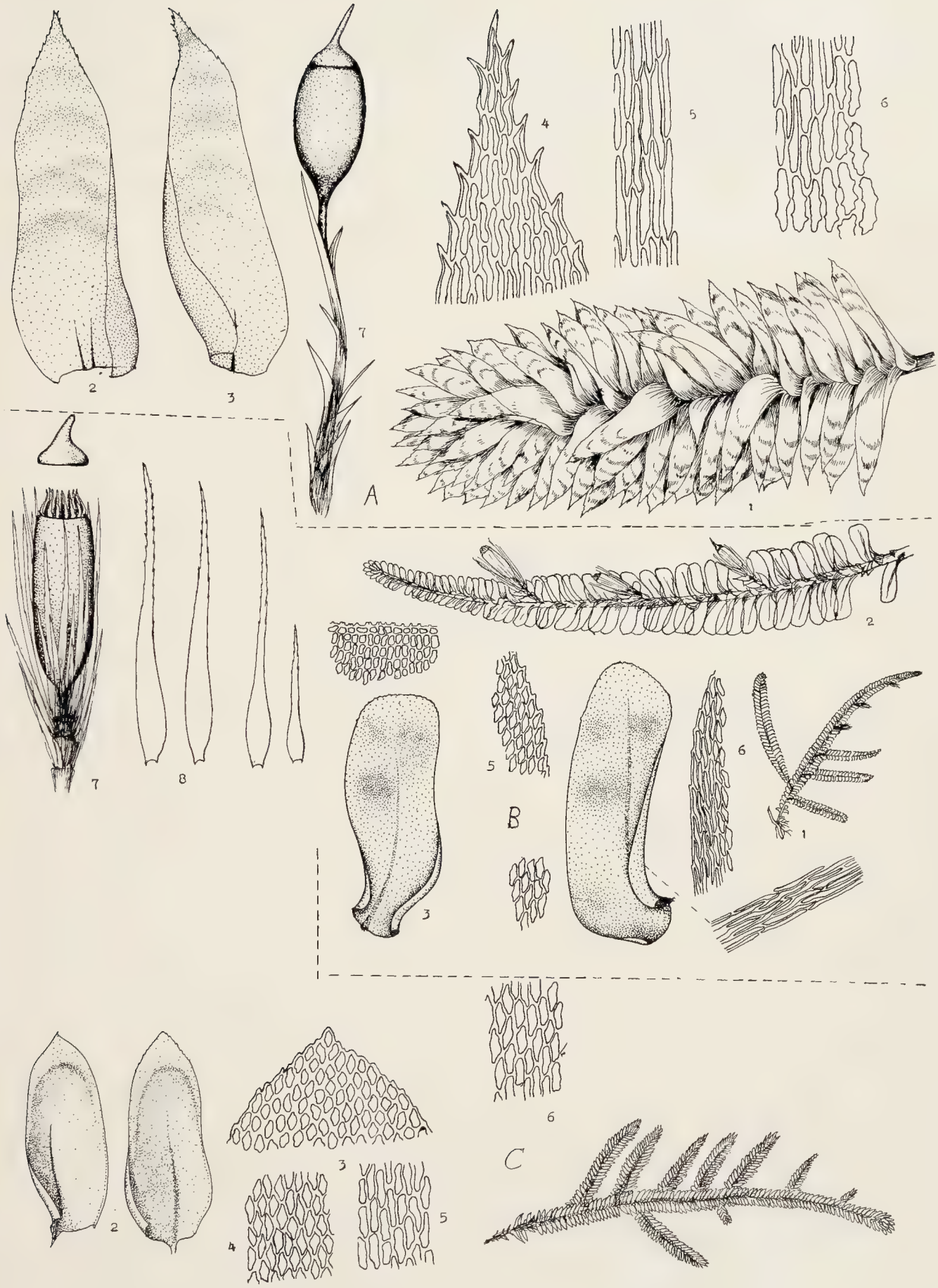


PLATE LX.

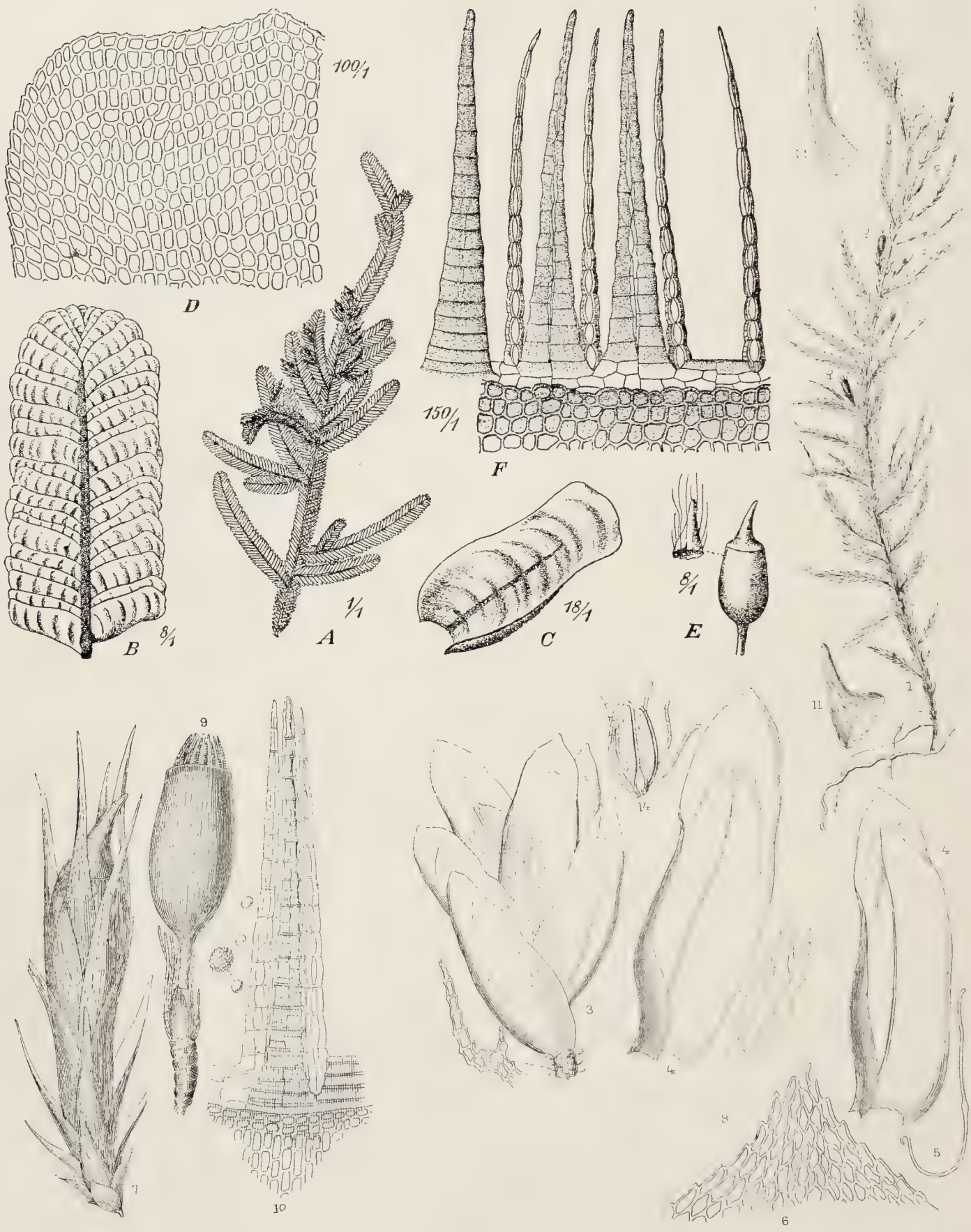


PLATE LXI.

PLATE 61. A–F. *Neckera undulata* (from Engler-Prantl, Musci (Ed. 2) *f. 571*). A, plant; B, portion of branch; C, leaf; D, apical leaf cells; E, capsule and calyptra; F, peristome.

1–12. *Neckera Menziesii* (from Sull. Icones Musc. Suppl. *pl. 62*). 1, plant × 1; 3, part of a branch with leaves and paraphyllia; 4, leaves; 5, cross section of leaf; 6, apex of leaf; 7, perichaetium; 9, capsule; 10, peristome; 11, operculum; 12, calyptra.

PLATE 62. A. *Neckera gracilis* (from Sull. Icones Musc, Suppl. *pl. 25*). 1, plant × 1; 2, part of a branch; 3, branch leaves; 4, leaves of branchlets; 5, cross section of a leaf; 6, basal and apical cells.

B. *Barbella pendula* (from Sull. Icones Musc. *pl. 73*). 1, plant × 1; 2, part of a fertile branch; 3, part of a branch with 2 leaves; 4, 5, 6, 7, leaves; 8, basal leaf cells; 9, 10, 13, apical cells; 11, perichaetium; 12, perichaetial leaf; 14, capsule; 15, operculum; 16, calyptra; 17, part of the peristome; 18, peristome tooth in side view.

PLATE LXII.

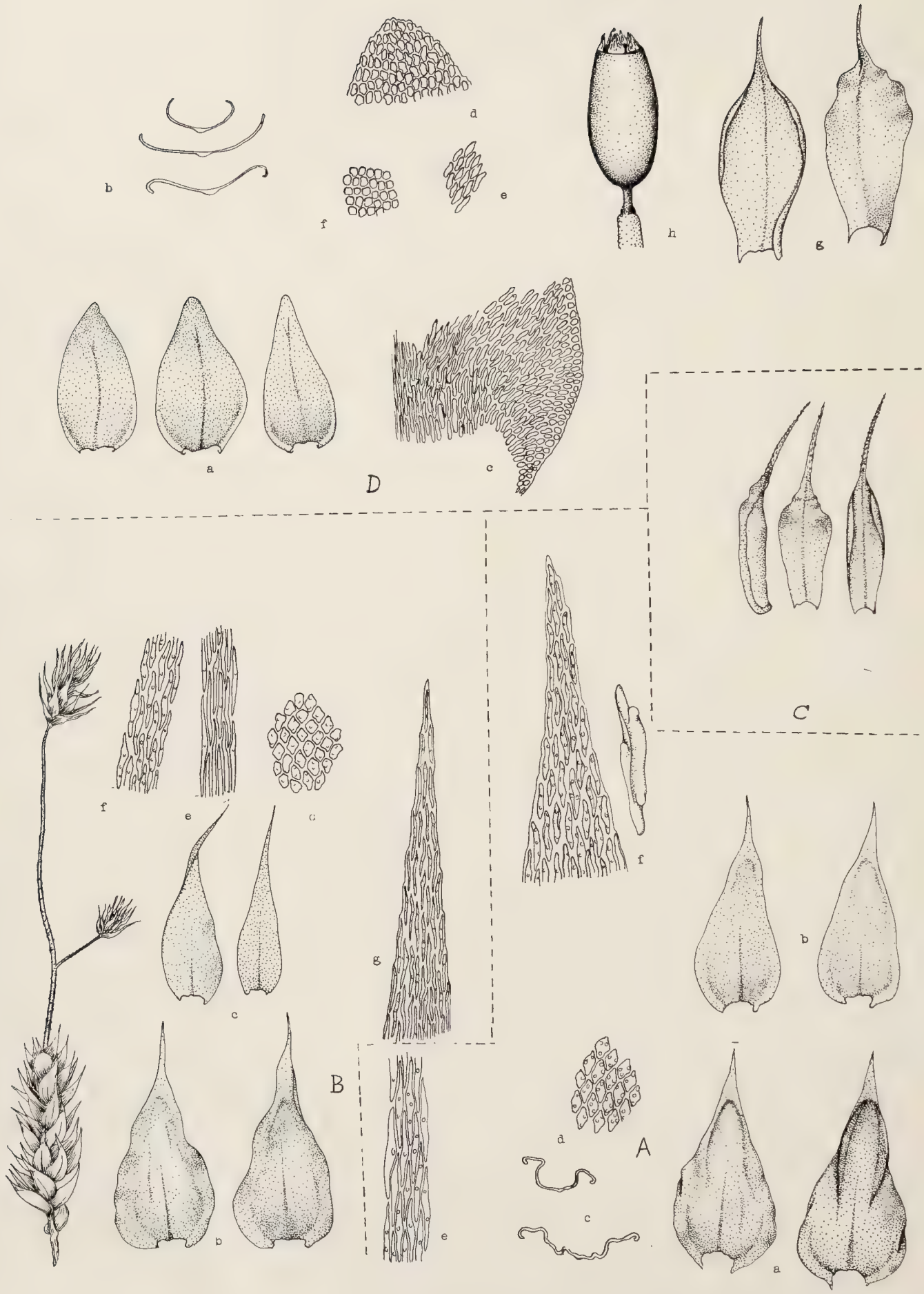


PLATE LXIII.

PLATE 63. A. *Tricholepis nigrescens;* a, leaves × 20; b, upper leaves × 20; c, cross-sections of leaves × 20; d, alar cells × 300; e, basal cells near costa × 300; f, apical cells × 300 and two cells × 1000.

B. *T. nigrescens Donnellii;* portion of a partially denuded branch × 5; b, leaves × 20; c, leaves of the end tuft × 20; d, alar cells × 300; e, basal cells near costa × 300; a, median cells × 300; g, apical cells × 300.

C. Three perichaetial leaves of *Cryphea glomerata scabra* × 10.

D. *Cryphaea Ravenelii;* a, three leaves × 20; b, cross-section of leaves; c, basal areolation × 300; d, apical cells × 300; e, cells from the lower median half of the leaf; f, cells from the upper ½ of leaf, both × 300; g, perichaetial leaves × 20; h, capsule × 20. (Drawings by Seville Flowers.)

PLATE 64. A. *Antitrichia californica* (from Sull. Icones Musc. *pl. 59*); 1, branch of fruiting plant dry × 4; 2, portion of stem, moist × 5; 3, portion of male plant, dry × 4; 4, stem leaves × 20; 5, branch leaves × 20; 6, basal areolation × 300; 7, median cells × 300; 8, apical cells × 300; 9, antheridial bud × 15; 10, perichaetium × 15.

B. *Leucodontopsis floridana;* 1, plant, natural size; 2, portion of secondary stem × 5, moist; 3, three stem leaves × 20; 4, 4, branch leaves × 20; 5, cross section of stem leaves; 6, 7, and 8, basal, median and apical cells respectively × 300. (Drawings by Seville Flowers.)

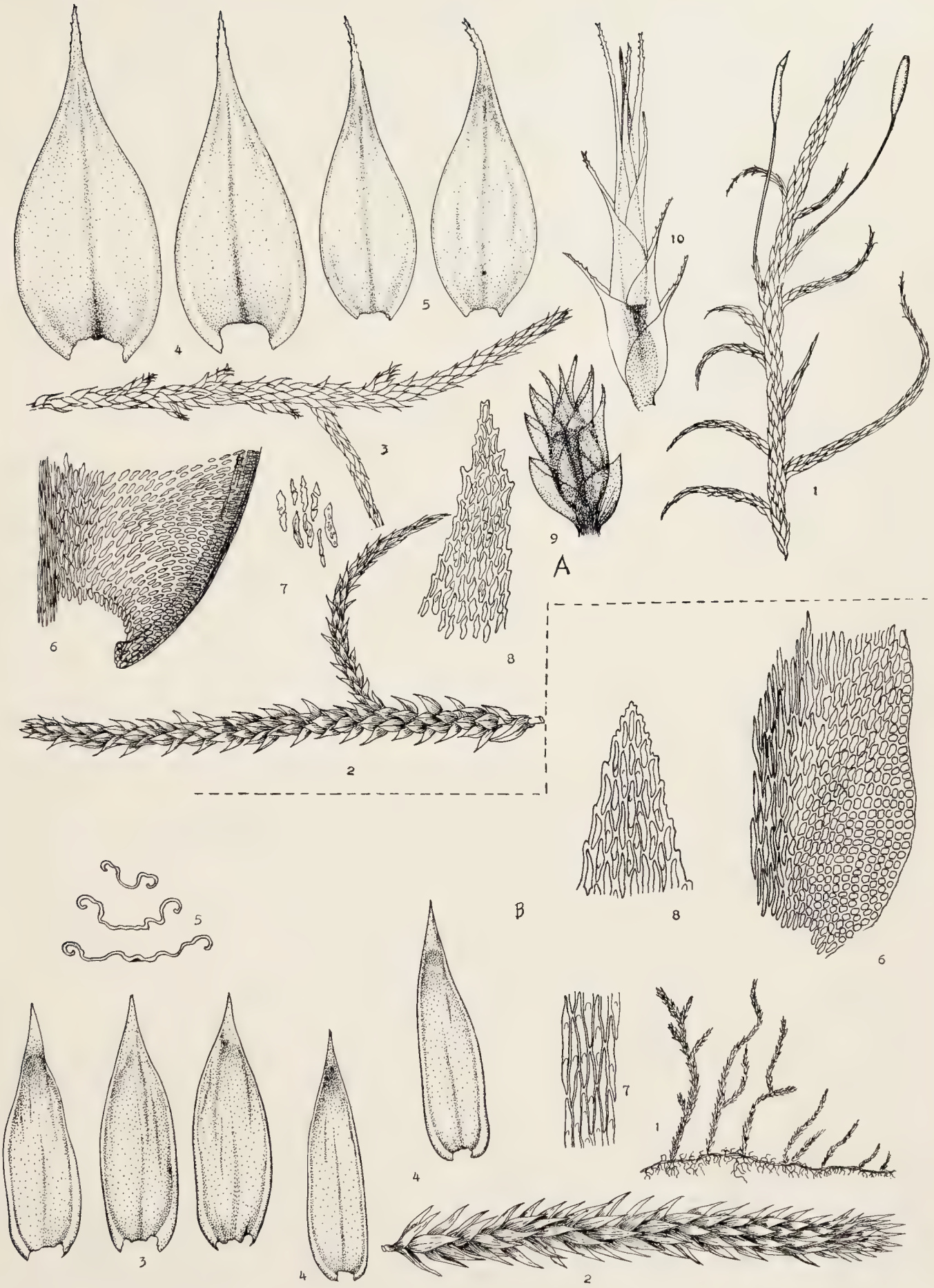
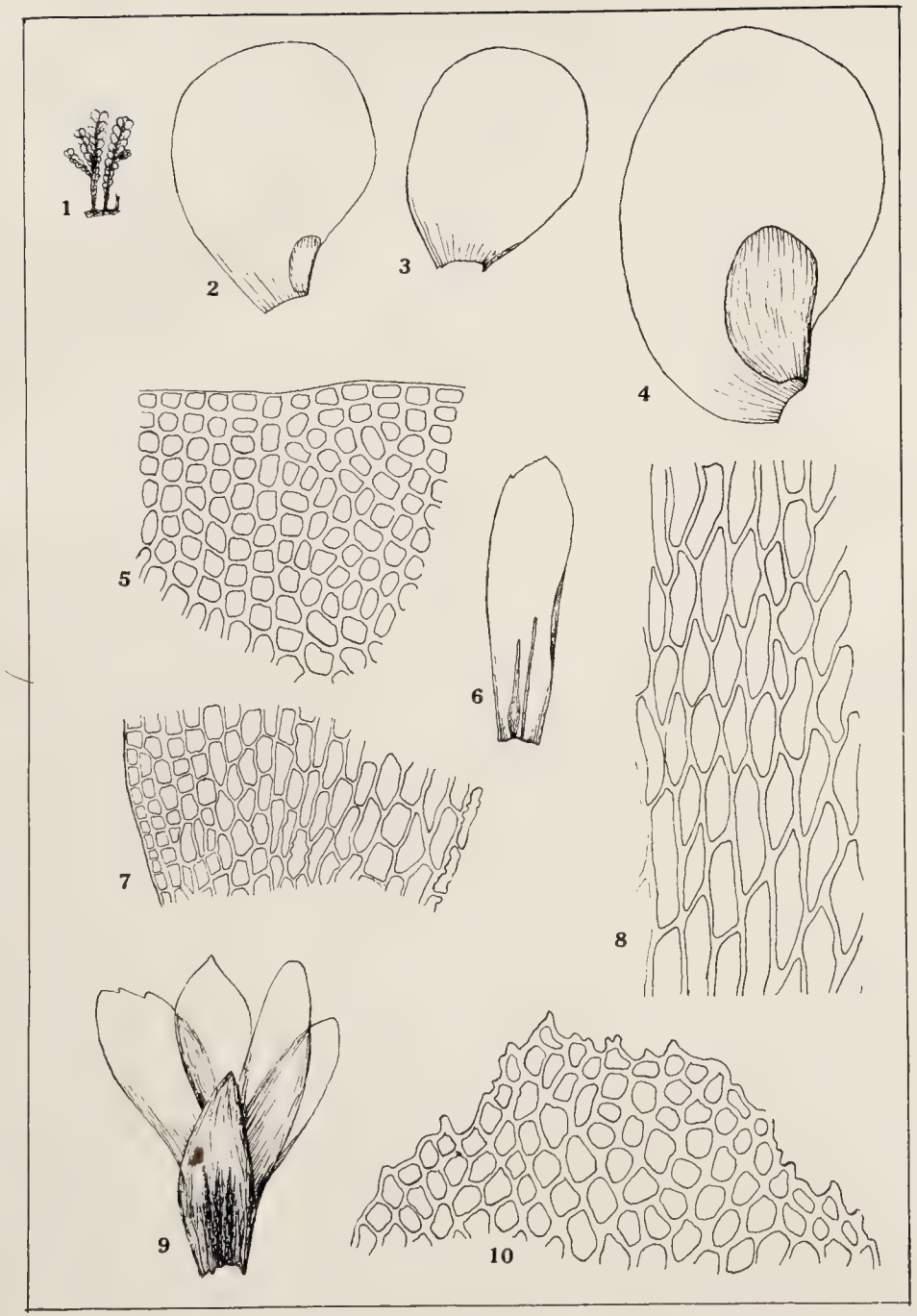
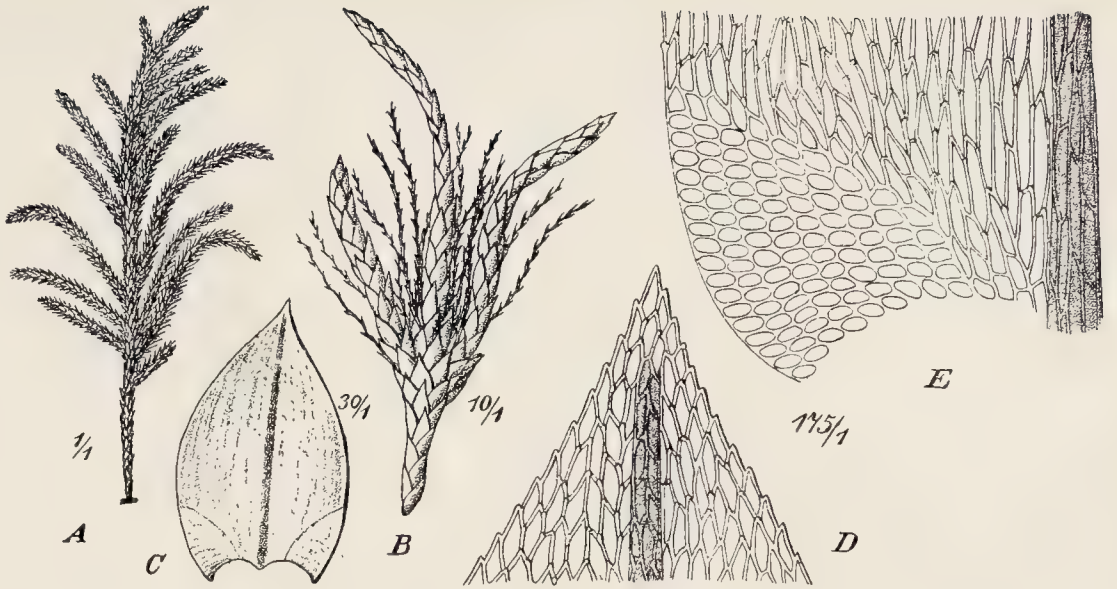


PLATE LXIV.





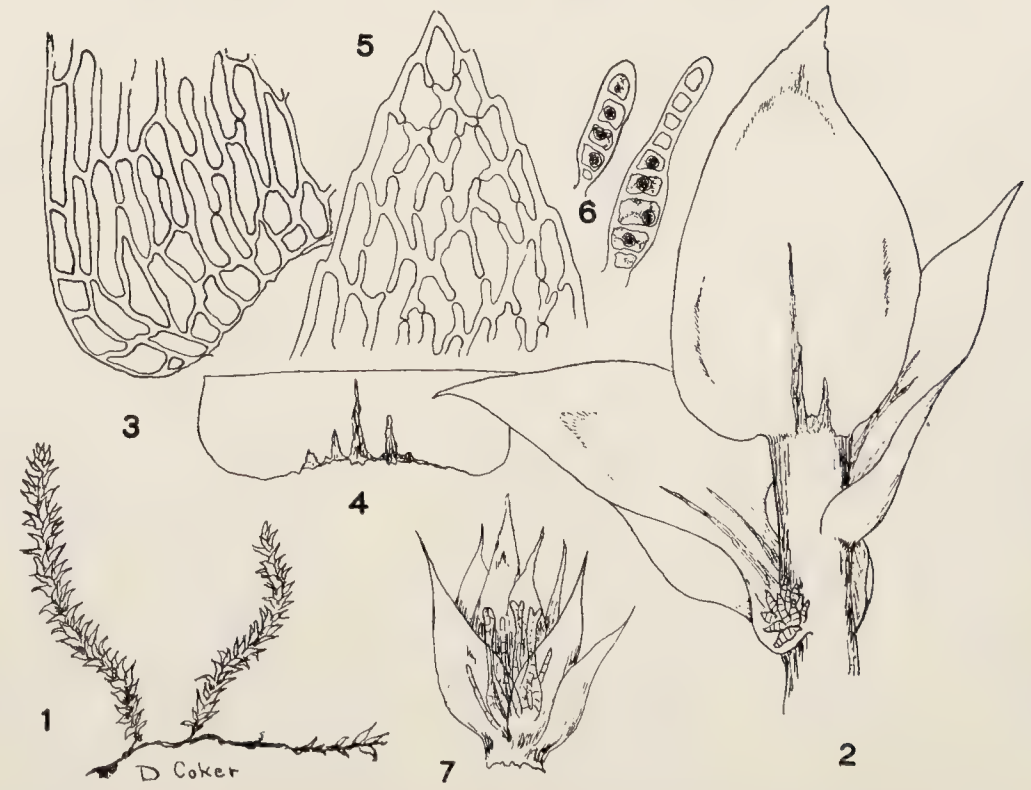


PLATE LXV

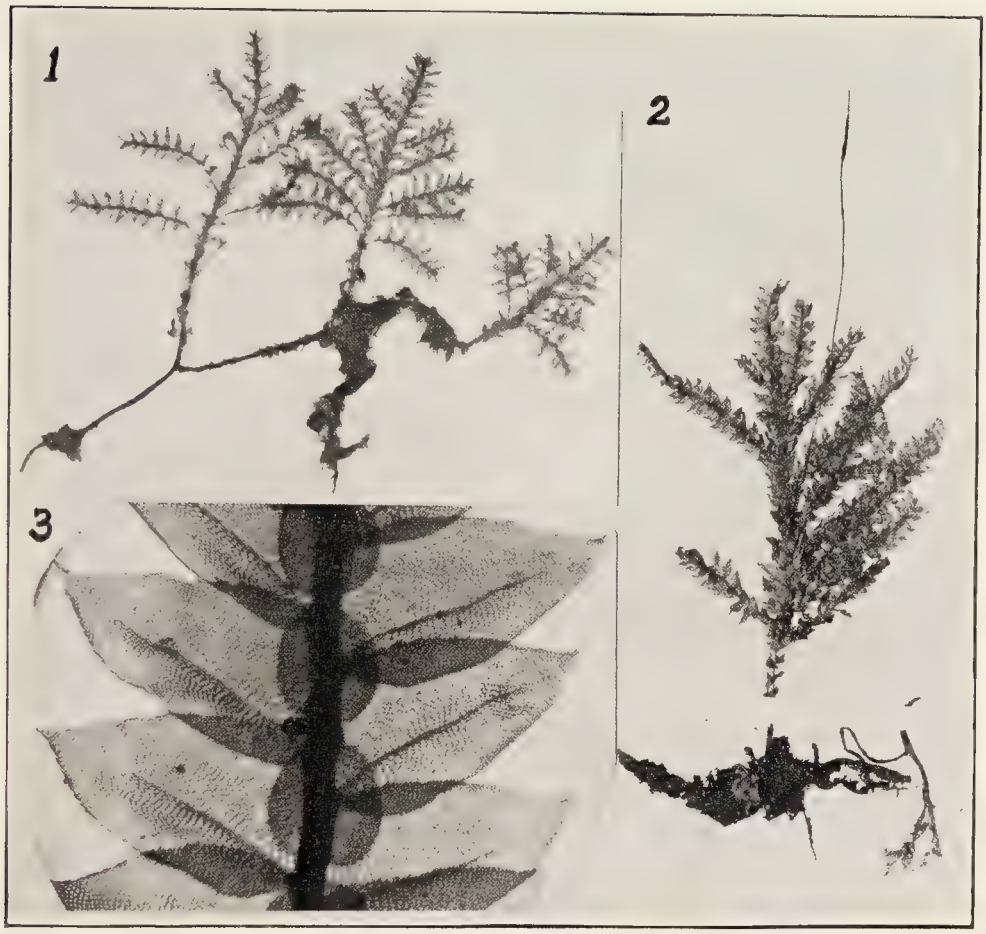
PLATE 65. Left, *Homalia Sharpii* (from Bryologist, **34**: *pl. 2*). 1, plant × 1; 2, 3, 4, branch leaves × 40; 5, apical leaf cells × 215; 6, inner perichaetial leaf × 40; 7, basal cells on one side of leaf × 215; 8, median leaf cells × 215; 9, perichaetial leaves × 40; 10, apex of perichaetial leaf × 215.

Upper right, A–E. *Pseudocryphaea flagellifera* [from Engler-Prantl, (Ed. 2) **2**: *f. 502*]. A, sterile plant; B, branchlets with flagella in a dry condition; C, stem leaf; D, leaf apex; E, leaf base.

Lower right, 1–7. *Jagerinopsis squarrosa* (from Bryologist **21**: *pl. 24*). 1, plant × 1; 2, part of stem enlarged showing axillary clusters of propagulae; 3, alar and basal leaf cells; 4, portion of leaf base showing variation in costa; 5, apical cells; 6, two propagulae; 7, archegonial bud.

PLATE 66. Above, *Hypopterygium japonicum* (from Bryologist **17**: *pl. 9*). 1, plant from Coronation Island, Alaska × 2; 2, plant from the island of Yoki, Tosa, Japan. 3, branch from Foster's plant showing the small ventral leaves, amphigastra.

Below, *Leucodon sciuorides* (from Limpricht, Laubm. **2**: *f. 330*, redrawn for Engler-Prantl). A, plant; B, leaf; C, capsule with calyptra; D, peristome; E, longitudinal section through peristome.



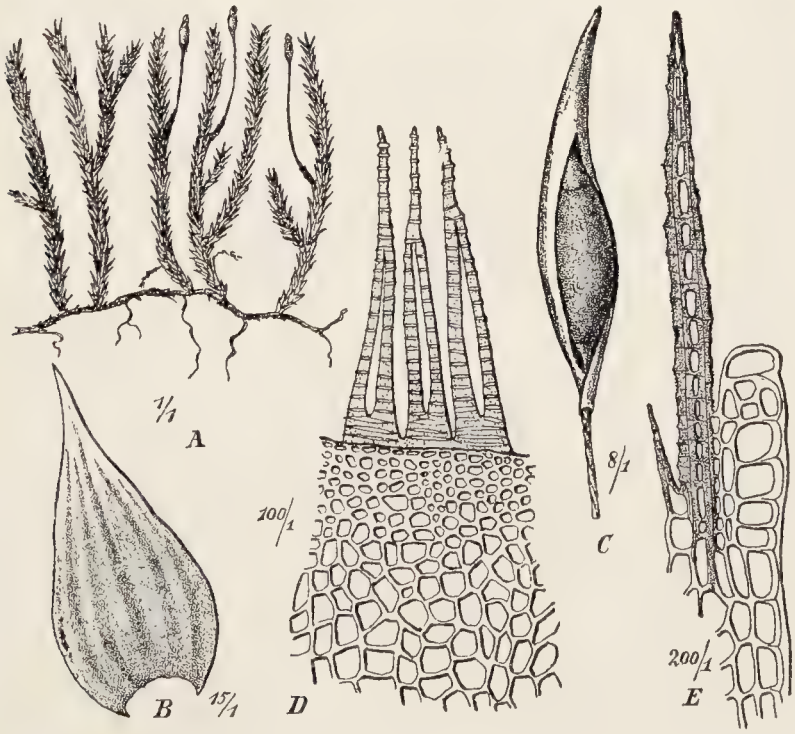


PLATE LXVI.

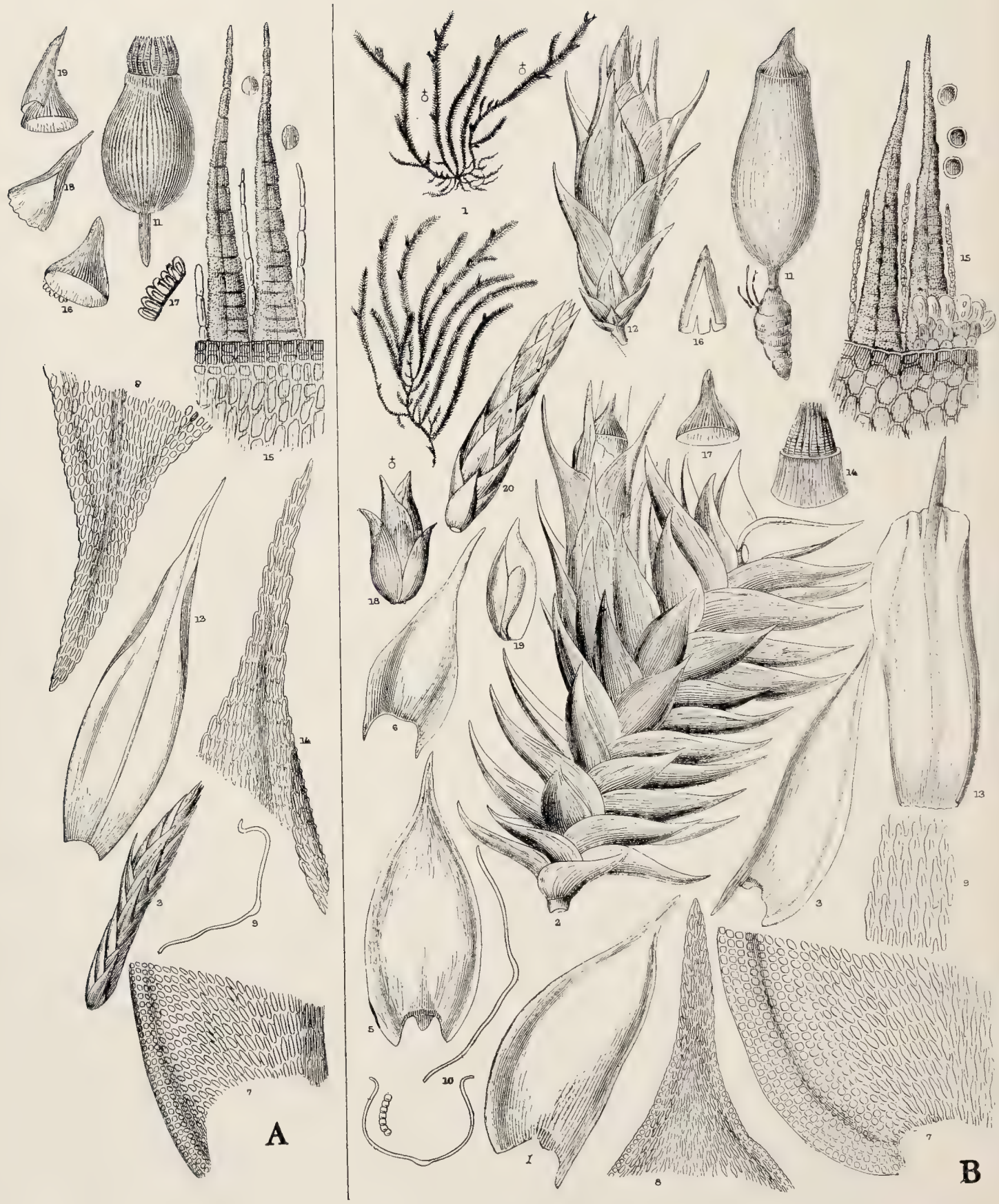


PLATE LXVII.

PLATE 67. A. *Cryphaea nervosa* (from Sull. Icones Musc. *pl. 68*). 3, part of a dry branch; 7, 8, basal and apical areolation; 9, cross section of leaf; 11, capsule; 13, perichaetial leaf; 14, papillose apex of perichaetial leaf; 15, peristome; 16, operculum; 17, part of annulus; 18, calyptra, 19; operculum and calyptra.

B. *Cryphaea glomerata* (from Sull. l. c. *pl. 67*). 1, plants × 1; 2, part of a moist fertile branch; 3, 4, 5, 6, leaves (wrongly depicted as ecostate); 7, basal cells; 8, 9, apical cells; 10, cross section of leaf; 11, capsule; 12, perichaetium with included capsule; 13, inner perichaetial leaf; 14, peristome; 15, peristome and annulus; 16, calyptra; 17, operculum; 18, antheridial bud; 19, perigonial leaf with antheridium; 20, part of a dry branch.

PLATE 68. A. *Leptodon ohioensis* (from Sull. Icones Musc. *pl. 72*). 2, part of a secondary stem; 3, 4, 5, leaves; 6, 7, base and apex of leaf; 8, 9, cross sections of leaf; 13, perichaetium and capsule; 14, calyptra; 16, 17, peristome.

B. *Leptodon nitidus* (from Sull. Icones Musc. Suppl. *pl. 60*). 2, part of a leafy stem; 3, leaf; 4, 5, apical and basal cells; 6, perichaetium and capsule; 7, perichaetial leaf; 8, capsule; 9, peristome; 10, germinating spore.

PLATE LXVIII.

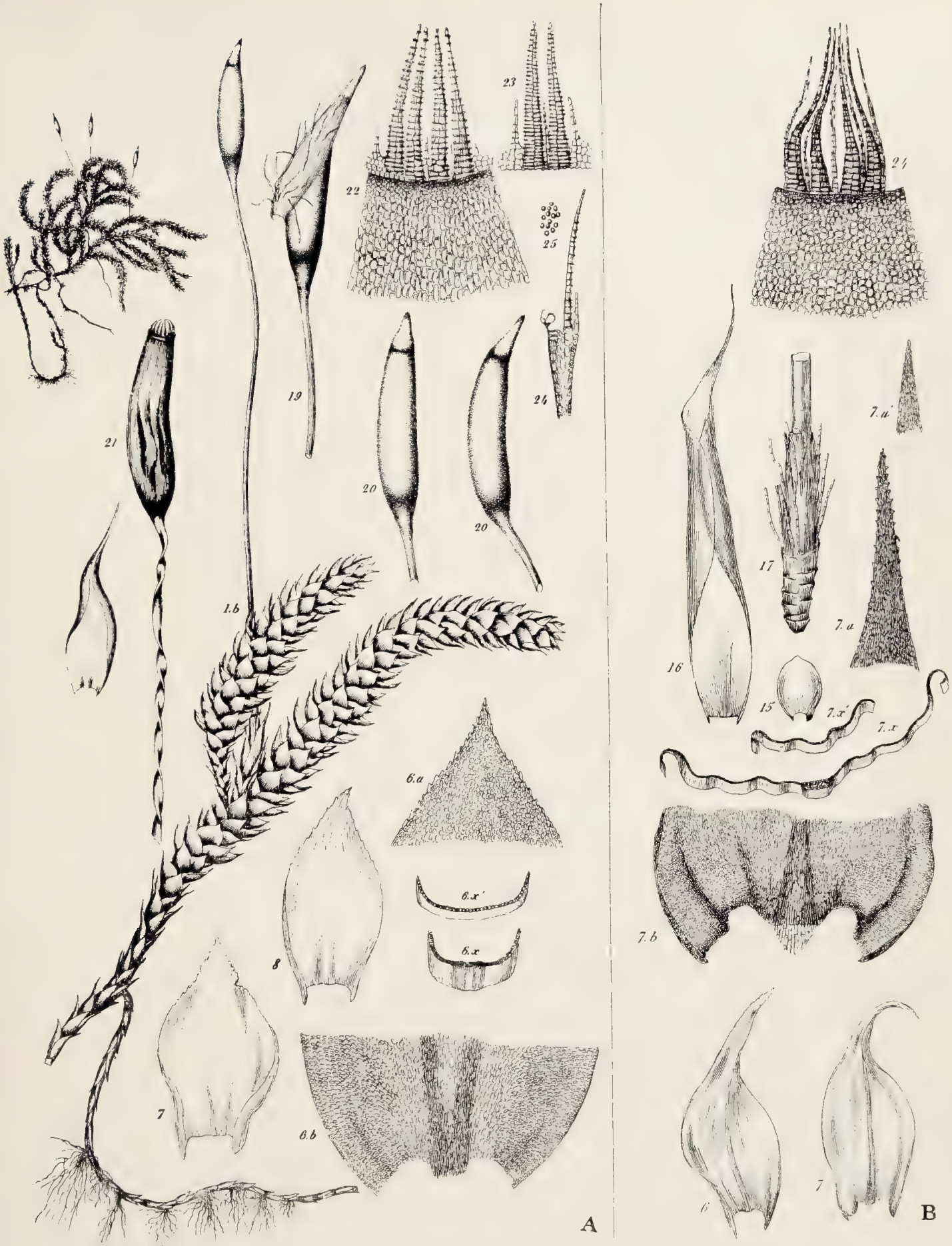
PLATE LXIX.

PLATE 69. A. *Clasmatodon parvulus* (from Sull. Icones Musc. *pl. 79*). 2, leafy branch; 3, leaf; 5, 6, leaves; 7, 8, apical and basal cells; 10, portion of cross section of leaf; 11, capsule with calyptra; 12, 13, calyptra and opercula; 17, portion of peristome; 18, longitudinal section of peristome.

B. *Dendroalsia abietina* (from Sull. Icones Musc. *pl. 72b*). 1, plant with capsules; 3, dry plant; 4, part of a branch; 5, branch leaf; 6, 7, basal and apical leaf cells; 9, 10, paraphyllia; 11, perichaetium, capsule and calyptra; 12, dry capsule; 14, inner perichaetial leaf; 15, 16, 17, peristome; 18, operculum; 20, 21, antheridia and paraphyses.

PLATE 70. A. *Pterogonium gracile* (from Bry. Eur. *pl. 467*). 1b, portion of plant enlarged; 6a, 6b, apical and basal leaf cells; 7, 8, leaves; 12, perigonial leaf; 19, 20, 21, capsules; 22, 23, 24, peristome, portions of annulus are shown in 22 and 24.

B. *Antitrichia curtipendula* (from Bry. Eur. *pl. 469*). 6, 7, leaves; 7a, 7b, apex and base of leaves; 7x, cross sections of leaf; 16, perichaetial leaf; 24, peristome.



HYPNACEAE
Pterogonium

PLATE LXX.

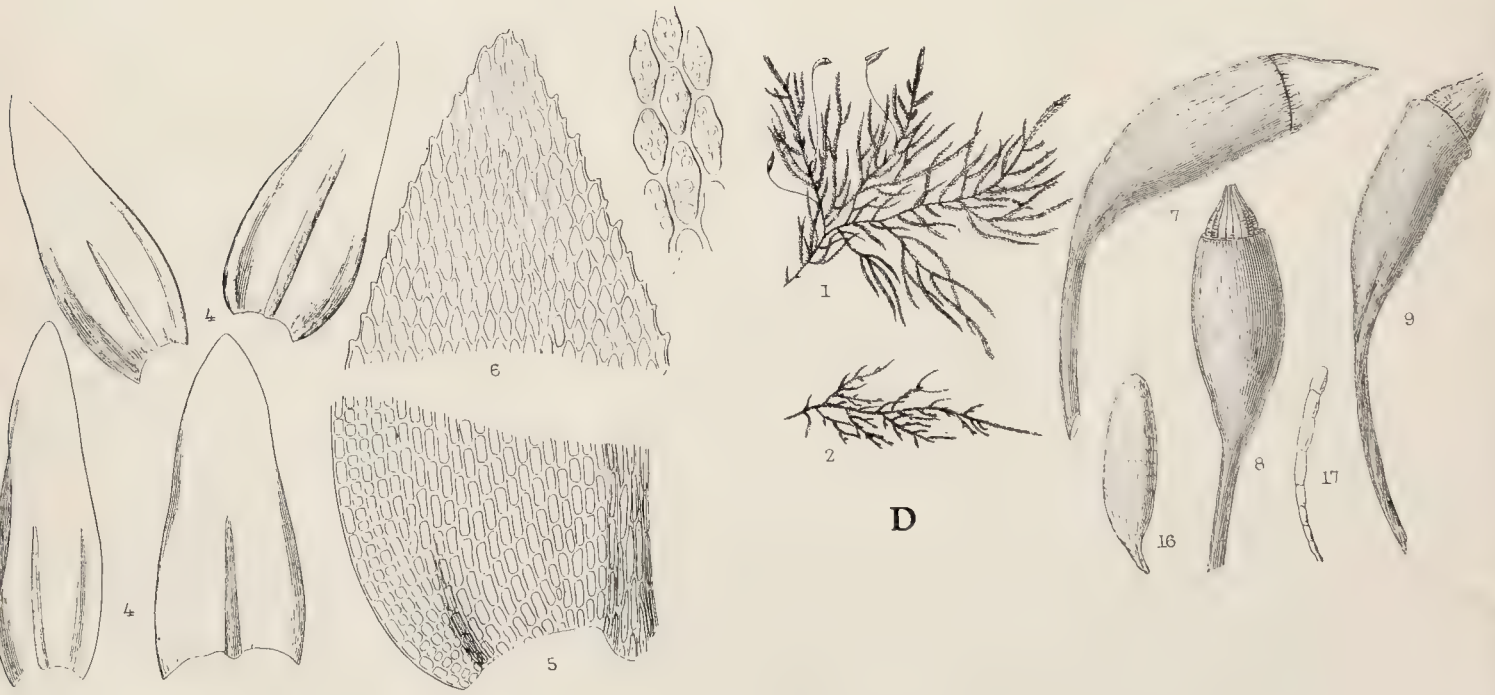


PLATE LXXI.

PLATE 71. A. *Leskea cyrtophylla.* 1, portion of plant × 6; 2, 3, leaves × 50; 4, 5, 6, cells of leaf apex, middle, and base respectively × 250.

B. *Leskea gracilescens.* 1, portion of plant × 5; 2, leaves × 30; 3, 4, 5, cells of leaf apex, middle, and base respectively × 450; 6, sporophyte × 10; 7, part of peristome × 125. (Drawings by A. J. Sharp.).

C. *Fabronia imperfecta* (from Bryologist 36: *pl. 1*). 6, sporophyte × 13; 7, capsule × 13; 8, peristome × 75; 9, 10, outlines of perichaetial leaves × 40; 11, branch leaf × 40; 12, areolation of branch leaf × 40.

D. *Bestia occidentalis* (from Sull. Icones Suppl. *pl. 81*). 1, 2, male and female plants × 1; 4, leaves; 5, 6, cells of base and apex; 7, 8, 9, capsules; 16, antheridium; 17, paraphysis.

PLATE 72. A. *Fabronia Wrightii* (from Sull. Icones Musc. *pl. 84*). 5, 7, leaves; 13, exothecial cells and peristome.

B. *Fabronia gymnostoma* (from Sull. l. c. *pl. 86*). 1, plants × 1; 7, leaf; 8, median leaf cells; 11, mouth of capsule showing membrane that seems to replace peristome; 16, perichaetial leaf.

C. *Fabronia Ravenelii* (from Sull. l. c. *pl. 85*); 2, fertile plant enlarged; 6, 7, leaves; 8, median marginal cells; 9, capsules; 11, perichaetial leaf; 13, operculum; 15, calyptra; 16, exothecial cells and part of peristome.

PLATE LXXII.

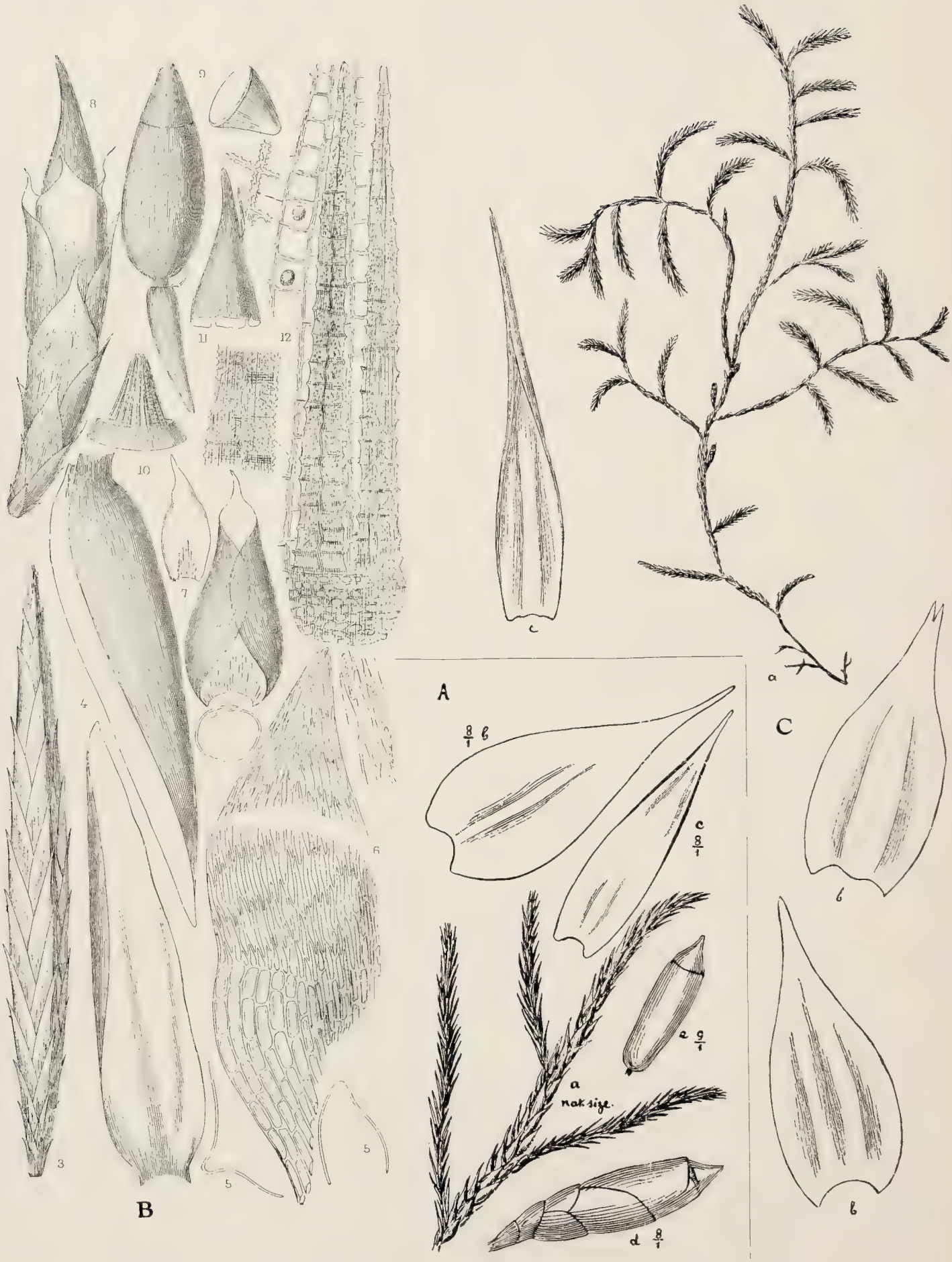


PLATE LXXIII.

PLATE 73. A. *Fontinalis Kindbergii* (from Bot. Gaz. **15**: *pl. 9*), a, portion of plant; b, stem leaf; c, branch leaf; d, perichaetium and capsule; e, capsule.

B. *Fontinalis neo-mexicana* (from Sull. Icones Musc. Suppl. *pl. 57*) 3, portion of branch showing tristichous leaves; 4, leaves; 5, cross sections of leaves; 6, basal and apical leaf cells (the alar not particularly distinctive); 7, perichaetial leaves; 8, perichaetium and capsule; 9, capsule and operculum; 10 and 12, peristome; 11, calyptra.

C. *Fontinalis Howellii* (from Bot. Gaz. **13**: *pl. 18*), a, portion of plant; b, b, (at lower right margin) stem leaves × 7; c, branch leaf × 16.

Plate 74. 1–3, *Fontinalis antipyretica* var. *gigantea*. 1, stem leaf × 8.5; 2, apex of same enlarged; 3, alar cells × 186.

4–7, *F. antipyretica* var. *mollis*. 4, stem leaf × 8.5; 5, 6, branch leaves × 8.5; 7, leaf apex enlarged (all from type duplicate).

8–10, *F. antipyretica* var. *oreganensis*. 8, 9, stem leaves × 8.5; 10, leaf apex enlarged.

11–13, *F. antipyretica* var. *patula*. 11, stem leaf × 8.5; 12, 13, leaf apices enlarged.

14–17, *F. antipyretica* (typical, from Bry. Eur., *pl. 429*, redrawn). 14, portion of stem with leaves; 15, leaf × 7; 16, perichaetium and capsule; 17, peristome.

18–22. *Fontinalis chrysophylla*. 18, stem leaf × 8; 19, apex of stem leaf × 314; 20, alar cells of the same × 162; 21, branch leaf × 8.5; 22, apex of branch leaf × 278.

23, 24, *Fontinalis neo-mexicana*. 23, stem leaf × 8.5; 24, leaf apex enlarged (see also *pl. 73*).

25–30, *Fontinalis Sullivanti*. 25, stem leaf × 8.5; 26, apices of stem leaves × 57; 27, branch leaf × 8.5; 28, apices of branch leaves × 57; 29, alar cells of branch leaf × 255; 30, perichaetial leaf × 8.5 (1–8 from Austin Musc. Appal. 249, 9 from Grout, Musc. Pl. 73).

31–36, *F. Sullivanti* var. *microdonta*. 31, stem leaf × 8.5; 32, apex of stem leaf × 57; 33, portion of branch with leaves × 8.5; 34, apex of branch leaf × 57; 35, alar cells of stem leaf; 36, perichaetium and capsule × 8.5 (from specimen in Renauld herbarium at Harvard; coll. Lesq. in 1883).

(All drawings by William Gray.)

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PLATE LXXIV.

PLATE LXXV.

PLATE 75. 1–9, *Fontinalis biformis.* 1, leaf of young (vernal) plant; 2, apical cells of same × 255; 3, median cells of same × 255; 4, alar cells × 255 (inverted); 5, 6, adult (aestival) leaves; 7, 8, perichaetial leaves; 9, calyptra, operculum and capsule in old perichaetial leaves [2–4 from Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 337]; the others redrawn from Sull. Icones Musc. *plates 59 & 60*).

10–14, *Fontinalis disticha.* 10, portion of branch with leaves; 11, stem leaves; 12, leaf apex × 255; 13, alar cells × 255; 14, capsule and operculum in perichaetial leaves [12, 13 from Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 227; the others redrawn from Sull. Icones Musc. *pl. 63*].

15–19, *Fontinalis missourica.* 15, stem leaves × 8.5; 16, apices of stem leaves × 57; 17, branch leaves × 8.5; 18, apex of branch leaf; 19, alar cells of stem leaf × 255 (drawn from *Demetrio*, 3810, near Cole Camp Creek, Benton Co., Missouri).

(By William Gray)

PLATE 76. 1–2, *Fontinalis Novae-Angliae* var. *latifolia*. 1, leaf × 8.5; 2, leaf apices × 59 (drawn from type or type duplicate).

3–6, *F. Novae-Angliae* var. *heterophylla*. 3, stem leaf × 8.5; 4, apex of same × 59; 5, branch leaf × 8.5; 6, apices of branch leaves × 59 (drawn from type or type duplicate).

7–10, *Fontinalis dalecarlica*. 7, portion of stem showing arrangement and form of the leaves; 8, leaf showing involute margins; 9, leaf apices enlarged; 10, perichaetium and capsule (7, 8, 10 from Bry. Eur. *pl. 431*).

11–15. *Fontinalis Allenii*. 11, leaf concave below and keeled above × 8.5; 12, leaf concave at base and plane above × 8.5; 13, 14, 15, leaf apices, carinate plane and concave × 56.8 (drawn from type or duplicate type). See *pl. 78*.

16–19 omitted.

20–23, *Fontinalis Novae-Angliae*. 20, perichaetium and capsule; 21, perichaetial leaf; 22, leaves × 8.5; 23, leaf apices enlarged (20, 21 from Sull. Icones Musc. *Pl. 65*).

24–25, *F. Novae-Angliae* var. *Lorenziae*. 24, leaf × 8.5; 25, leaf apices × 59 (drawn from type or type duplicate).

26–28, *F. Novae-Angliae* var. *involuta*. 26, leaf with narrowly involute margins; 27, leaf with broadly involute margins, both × 8.5; 28, leaf apex × 59.

29–30, *F. Novae-Angliae* var. *Delamarei*. 29, leaves × 8.5; 30, leaf apices × 59 (from type or type duplicate).

31–32, *F. Novae-Angliae* var. *Waghornei*. 31, leaf × 8.5; 32, leaf apices × 59 (from type or type duplicate).

(All by William Gray)

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PLATE LXXVI.

PLATE LXXVII.

PLATE 77. 1–5, *Fontinalis hypnoides.* 1, portion of stem with branch; 2, stem leaves; 3, apices of median leaves on the same branch × 255; 4, leaf base × 150; 5, mature capsule and perichaetium (1, 2 and 5, redrawn from Bry. Eur. *pl. 432;* 3 and 4 from *Leiberg*, W. Am. Mosses, 137).

6–8, *Fontinalis nitida.* 6, base of stem leaf × 8.5; 7, leaf apex × 255; 8, alar cells × 255 (drawn from *Grout*, N. Am. Musc., Pl. 297).

9–11, *Fontinalis tenella.* 9, leaf × 8.5; 10, leaf apex × 255; 11, alar cells × 255 (drawn from type duplicate).

12–15, *Fontinalis Duriaei.* 12, 12, stem leaves × 8.5; 13, leaf apices × 57; 14, alar cells × 255; 15, perichaetium and capsule (12–14 from *Holzinger*, Mosses N. E. Minnesota, Rosebush Falls, 7-28-1902; 15 from Husnot, Musc. Gall. *pl. 81*).

16–18, *Fontinalis denticulata.* 16, stem leaf × 8.5; 17, leaf apices × 57; 18, alar cells × 255 (drawn from a supposed type duplicate).

PLATE 78. 1–5, *Fontinalis Lescurii*. 1, stem leaf; 2, alar cells × 170; 3, perichaetium with capsule completely immersed; 4, perichaetial leaf; 5, portion of peristome (2 from *Nichols*, Conn. 4-14-1911, the rest redrawn from Sull. Icones Musc. *pl. 61*).

6–10, *F. Lescurii* var. *ramosior*. 6, stem leaf; 7, leaf apices × 170; 8, 8, perichaetium and capsule; 9, perichaetial leaf; 10, portion of peristome (7 drawn from Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 224c, the others redrawn from Sull. Icones Musc. *pl. 62*).

11, alar cells of *F. Allenii* × 170.

a–d, *Fontinalis flaccida*. b–b′b′, leaf apices, b′b′ × 38; aa. leaves; c, alar cells; d, median cells (b′, from duplicate type, the others reproduced from Bot. Gaz. **13**: *pl. 19*).

(All drawings except a, d by William Gray.)

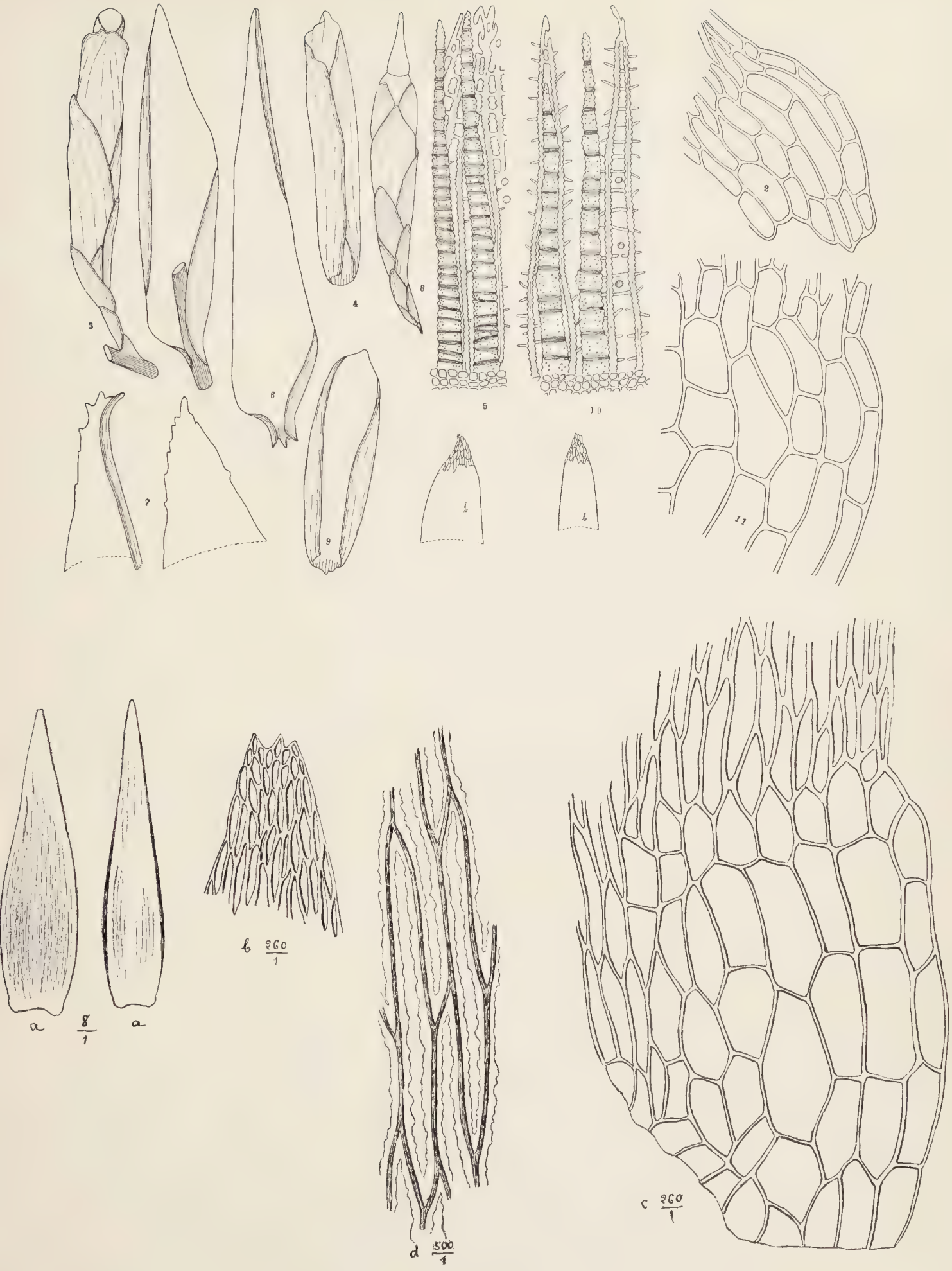


PLATE LXXVIII.

PLATE LXXIX.

PLATE 79. 1–3, *Fontinalis MacMillani.* 1, leaf × 6; 2, leaf apices × 38; 3, alar cells × 170.

4–8, *Fontinalis subcarinata,* 4, portion of stem, showing 4-ranked leaves; 5, plane stem leaf × 6; 6, subcarinate stem leaf × 6; 7, apex of stem leaf × 170; 8, alar cells × 170 (4, redrawn from Bot. Gaz. **37:** *pl. 23, f. 2b;* 5–8, from Macoun, 264, Assiniboia, Canada).

9–11, *Fontinalis dichelymoides.* 9, stem leaf × 15; 10, leaf apex × 170; 11, alar cells × 170 (9, redrawn from Engler & Prantl (Ed. 2) **11:** *f. 476;* 10, from specimen from Vermilion Lake, Minn. July 21, 1886, *Arthur;* 11, from specimen from Lake Piojärvi, Finland, Aug. 7, 1896, *Brotherus*).

12–14. *Fontinalis filiformis.* 12, stem leaves; 13, leaf apex × 170; 14, perichaetium and capsule; (13 from a specimen collected in southern Kentucky by Lesq., in herb. Austin; others from Sull. Icones Musc. *pl. 64*).

16–18, *Fontinalis Langloisii.* 16, stem leaves × 6; 17, leaf apices × 38; 18, leaf apices × 170 (from *Langlois,* Flora Ludoviciana 648).

19–26, *Brachelyma subulatum.* 19, stem leaves; 20, leaf apices × 38; 21, marginal leaf cells × 170; 22, median leaf cells × 170; 23, alar cells × 170; 24, seta, capsule, operculum and calyptra; 25, perichaetial leaf; 26, outer and inner peristome (20–23 from *Small,* Georgia Mosses, 5079; the others from Bry. Eur. *pl. 434*).

27–30, *Brachelyma robustum.* 27, stem leaf × 6; 28, leaf apex × 170; 29, marginal leaf cells × 170; 30, median leaf cells × 170 (from *Harper,* Georgia Plants 1919a).

31–34, *Dichelyma falcatum.* 31, stem leaf; 32, leaf apices × 170; 33, inner perichaetial leaf; 34, seta, capsule, and dimidiate clasping calyptra. (32 from Grout, Musci Pl. 396; the others from Bry. Eur. *pl. 433*).

35–37, *Dichelyma uncinatum.* 35, stem leaf × 6; 36, leaf apex × 170; 37, perichaetium, seta, and capsule (after Mitten, Journ. Linn. Soc. 8: *pl. 8;* 35 & 36 from Lyall, Oregon Boundary Commission, 1861).

38–42, *Dichelyma capillaceum.* 38, portion of stem with leaves; 39, leaf apex; 40–41, perichaetial leaves; 42, perichaetium and capsule (from Bry. Eur. *pl. 436*).

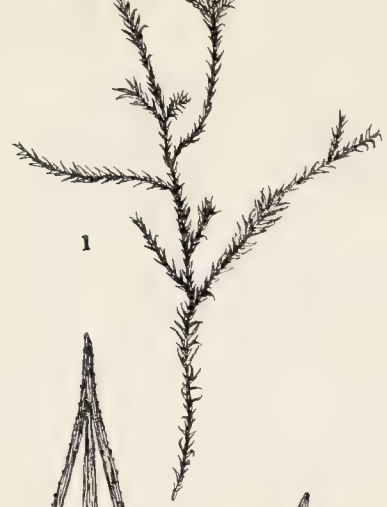
43–47, *Dichelyma pallescens.* 43, stem leaves; 44, leaf apices × 38; 45, leaf apex × 170; 46, perichaetium, capsule, and calyptra; 47, perichaetium and laterally emergent capsule (42–45 from Austin, Musc. Appal. Suppl. 525; others from Bry. Eur. *pl. 525*).

(All drawings on this plate made by William Gray)

PLATE 80. Left, *Sciaromium Fryei* (from the Bryologist 35: *pl. 5*). 1, plant × 1; 2, portion of cross-section of stem × 200; 3, stem leaf × 15; 4, upper branch leaf × 15; 5, cross-section of leaf × 120; 6, border cells well down leaf × 160; 7, basal leaf angle × 160; 8, median cells and border × 160.

Upper right, *Rhynchostegiella georgiana* (from Bryologist 33: *pl. 4*). 1, portion of fruiting plant dry; 2, portion of same moist; 3, leaves; 4, apical cells; 5, cells of basal angles.

Lower right, *Hygroamblystegium macroneuron* (from Bryologist 36: *f. 1*). 1, plant × 1.5; 2, 3, leaves (too blunt at apex); 4, leaf apex × 350; 5, median leaf cells × 350.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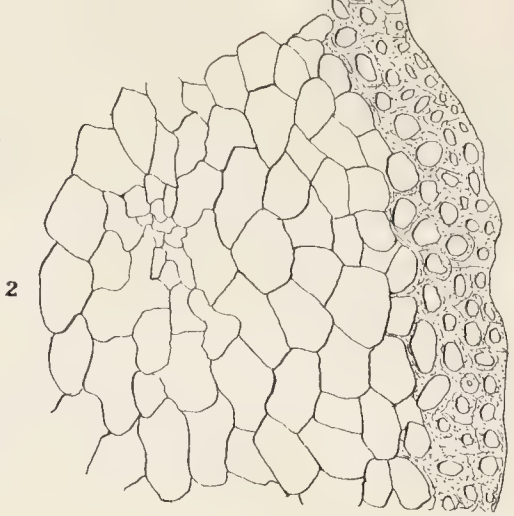
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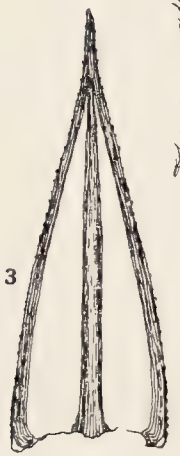
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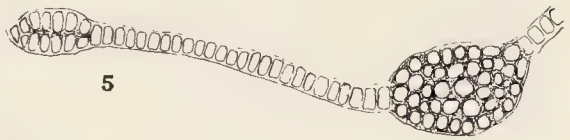
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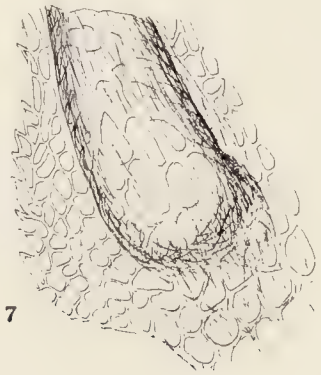
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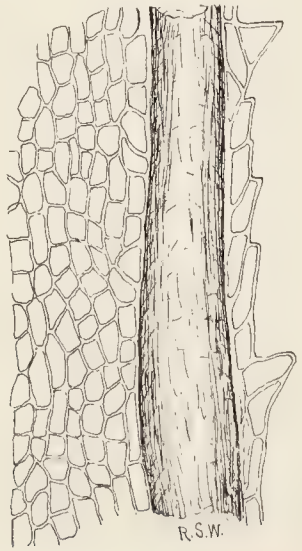

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Plate LXXX.

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